APPENDIX A

Attached is a Declaration Under 37 C.F.R. § 1.132 from Dr. Richard Boyd.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	10/749,122	Art Unit:	1632
Applicant:	Richard L. Boyd	Examiner:	David A. Montanari
Date Filed:	December 30, 2003	Conf. No.	3280
Docket No.	NOR-014CP4 and 286336.153US1	Cust. No.	23483
Title:	**DISEASE PREVENTION BY REACTIVATION OF THE THYMUS**		

DECLARATION OF DR. RICHARD L. BOYD UNDER 37 C.F.R. § 1.132

Dear Sir:

In connection with the above-referenced patent application, I, Richard L. Boyd, declare as follows:

1. I received my Ph.D. degree in Immunology from Monash University, Australia in 1976. I was a Senior Tutor in the Department of Pathology and Immunology at Monash University from 1976-1977. I held a research fellowship at the University of Innsbruck, Austria, from 1978-1982, following which I held a Research Fellow position from 1983-1984. I was a Lecturer at Monash University from 1985-1994. Currently, I am an Associate Professor in the Department of Immunology at Monash University. I am also the Director of the Immunology Platform Program at the Australian Stem Cell Center and the Deputy Director of Monash Immunology and Stem Cell Laboratories. I have authored or co-authored more than 193 journal articles in the area of immunology and presented over 500 oral presentations at conferences and research institutes. I was the Editor-in-Chief of *Developmental Immunology* from 1999-2003, and a member of the editorial boards of *Developmental and Comparative Immunology* (1993-2003) and of *Clinical and Developmental Immunology* (2004-2006). I review articles for numerous journals including, *Nature, Nature Immunology, Blood, Autoimmunity,* and the *Journal of Experimental Medicine.* I was the recipient of two awards from the Australian Federal Government and a co-recipient of two international prizes for my research. My *curriculum vitae,* which includes a list of my publications and presentations, is provided as **Attachment A** following ***page 6*** of this Declaration.

2. I am the Chief Scientific Officer of Norwood Immunology Limited, the Assignee of the above-referenced application.

3. I am the sole inventor of the above-referenced patent application and accordingly am familiar with the above-referenced patent application. I am also familiar with the Office Action dated August 24, 2007 (hereinafter "Office Action") in the above-referenced application.

4. As I understand the Office Action, the Examiner rejected the pending claims, in part, as not being enabling (*see*, Office Action, pages 4-7). The Office Action states, in relevant part, that: "Whereas the nature of the invention is a method of increasing thymus activity (producing more thymocytes) by disruption of sex steroid influences via chemical castration, the art teaches that such a method would not prevent or treat all disease." (*see*, Office Action, page 4, last paragraph).

5. As amended, the claims of my application are directed, in part, to methods for treating or increasing resistance to a viral infection in a patient by reactivating the thymus of the patient. My patent application teaches a trained clinical immunologist how to make and use the invention as claimed in this application.

6. The application provides sufficient guidance to a trained clinical immunologist to practice the invention as claimed, for example, at page 30, lines 4-30; page 60, lines 14-31; Example 3; Figures 14-19; and Example 10 of the application as filed.

7. In this Declaration, I provide further experimental evidence to show that the disclosure in the application as filed is sufficient to teach a trained clinical immunologist to make and use my presently claimed invention. Specifically, the experiments described below show that the claimed methods are useful in treating or increasing resistance to influenza infections.

8. Cytotoxic T cells play a major role in the control and eventual elimination of viral infections. Subjects with decreased thymic activity (*e.g.*, the aged) display increased susceptibility to viral infections, such as influenza A virus, and this may reflect either diminished CTL capacity or loss of antigen-specific CTL. Utilizing a well-characterized model of influenza A virus infection in C57BL/6J mice, we assessed the capacity of aged mice to respond to both primary and secondary viral infection.

8. Intranasal infection of C57BL/6J (B6) mice with Influenza A virus causes an acute respiratory pneumonia with virus cleared around ten days post infection. This time point corresponds with the peak of the lymphocytic infiltrate found in broncheaveolar lavage (BAL). The primary $CD8^+$ T cell response is largely specific for three determinants derived from the nucleoprotein ($NP_{366-374}$ (NP366); amino acid sequence ASNENMETM), acidic polymerase ($PA_{224-233}$ (PA224); amino acid sequence SSLENFRAYV) and basic polymerase 1 ($PB1_{703-711}$ (PB1703); amino acid sequence SSYRRYPVGI) of the virus. Influenza A virus-specific CTL play a major role in limiting and eventual clearance of influenza A virus infection. For example, increased CTL numbers after infection correlate with decreased viral shedding and protection from heterologous virus challenge where humoral immunity is limited.

9. The capacity of aged mice (9 mths - 24 mths) to respond to influenza A virus infection, as measured by CTL responses against the epitopes NP366, PA224 and PB1703, was compared to young animals. Young mice (6-8 weeks) or mice aged 9, 18, or 24 mths were infected intranasally (i.n.) with 10^4 pfu of A/HKx31 influenza A virus. The specific CTL responses for NP366, PA224, and PB1703 were determined by intracellular cytokine staining at days 3, 7, 10, and 14 after infection. No difference was observed between the young and aged mice at day 3 after infection, presumably due to low CTL numbers that soon after infection. However, aged mice demonstrated both a lower percentage and number of $CD8\alpha^+IFN\text{-}\gamma^+$ CTL at day 7 and 10 ($p<0.01$) for all epitopes tested (*see,* **Attachment B**, Figs.1A, and 1B). These data show that

following intransal influenza infection, aged mice have a decreased number of influenza-specific CTLs compared with younger mice.

10. We next determined the naïve T cell:memory T cell ratio in the young and old mice. Using expression of CD62L and CD44 to define naïve (CD62Lhi/CD44lo) and memory (CD62Lhi/CD44lo) CTL phenotypes, we observed a significant age-dependent decline in the naïve T cell:memory CTL ratio (*see*, **Attachment C**, Fig 2A, $p<0.01$) when compared to young mice. This loss of naïve T cell precursors is presumably due to an aged-related decrease in thymic output. Sex steroid ablation (SSA) can increase thymic output due to release of thymic stroma from sex-steroid repression of thymic function. Utilizing castration as a method of SSA, the impact of removing sex-steroid repression on the naïve T cell:memory T cell ratio was determined in mice aged 9, 18, and 24 mths (*see*, **Attachment C**, Fig. 2B). A significant ($p<0.05$) increase in the naïve T cell:memory T cell ratio was observed in all aged mice compared to their sham castrated counterparts. However the level of restoration appeared age-dependent with 9 mth old castrated mice showing a return to a naive:memory ratio similar to that seen in young mice (*see*, **Attachment C**, Fig 2B). In contrast, despite a level of restoration, 18 mth and 24 mth old Cx mice did not show a return to the levels seen in young mice ($p<0.01$).

11. We then determined whether increased numbers of naive $CD8\alpha^+$ T cells observed following castration would restore virus-specific CTL responses to influenza A virus infection. Mice aged 9, 18, and 24 mths were castrated and infected i.n. with with A/HKx31 6 weeks later. Fewer NP366-specific CTL were elicited after infection of sham castrated mice demonstrating the age related diminished response to infection compared to young mice (*see*, **Attachment D**, Fig. 3A, B, $p<0.05$). Following castration both 9 mth and 18 mth old mice showed recovery of both the proportion (*see*, **Attachment D**, Fig. 7A, $p<0.05$) and absolute number (Fig. 3B, $p<0.05$) of $CD8\alpha^+IFN\gamma^+$ CTL when compared that seen in young mice (*see*, **Attachment D**, Fig 3A, B). Interestingly, 24 mth old castrated mice did not show the same recovery indicating that sex

steroid ablation may have age-limited positive effects on improving the response to influenza virus infection (*see*, **Attachment D**, Fig. 3A, B).

12. Analysis of CTL cytotoxicity demonstrated that the increase in $CD8\alpha^{+}IFN\gamma^{+}$ cell numbers due to castration corresponded with increased anti-influenza-specific cytotoxic activity in 9 mth old mice. Importantly, the restoration was equivalent to the cytotoxic responses observed in young mice while sham castrated mice demonstrated decreased cytoxicity compared to young mice (*see*, **Attachment D**, Fig. 3C). A strong correlation was again seen between cytotoxic activity and the number of NP366-specific CTL (*see*, **Attachment D**, Fig. 3D). Furthermore, there was no difference in the capacity of sham castrated and castrated aged mice to produce cytokine after peptide stimulation (data not shown).

13. To determine if the subsequent restoration of CTL responses improved viral clearance, lung viral titres were determined day 7 after i.n. infection of young mice and compared to aged sham castrated and castrated mice (*see*, **Attachment E**, Fig 4). Sham castrated mice aged 9 and 24 mths had significantly higher viral titres when compared young mice ($p<0.05$). Importantly, 9 mth castrated mice showed significantly improved viral lung clearance to a level similar to that observed in normal young mice (*see*, **Attachment E**, Fig 4, $p<0.05$). There was also improved viral clearance in castrated mice aged 24 mths although this wasn't to the level observed in 9 mth castrated mice. Overall these data show that sex-steroid ablation restores the numbers of anti-influenza A virus CTL generated after infection and that correlates in improved viral clearance.

14. In summary, these data show that reactivating the thymus of the patient can be used to treat or increase resistance to a viral infection.

15. Based on the discussion above, I respectfully submit that the above-referenced application does teach how to make and use the invention as presently claimed.

16. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: February 22nd 2008

Richard L. Boyd, Ph.D.

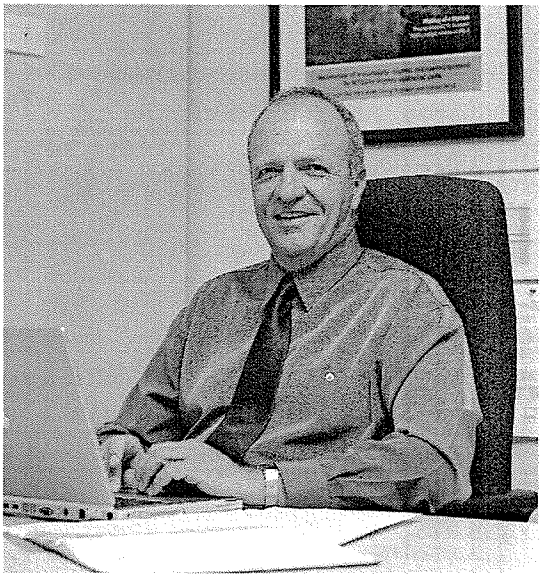
ATTACHMENT A

Attached is the *curriculum vitae* of Dr. Richard L. Boyd.

CURRICULUM VITAE

Richard Boyd

November 2007



Personal Details			
Full name:	Richard Lennox Boyd	Title: Professor	
Current position:	Director		
Department/School/ Section:	Monash Immunology and Stem Cell Laboratories (MISCL) / School of Biomedical Sciences		
Faculty/Division:	Medicine, Nursing and Health Sciences	Campus:	Clayton
Correspondence address:	MISCL, Lvl 3, Bldg 75, Monash University, Wellington Rd, Clayton, 3800		
Email address:	richard.boyd@med.monash.edu.au		

Academic Qualifications

Formal qualifications

Year	Qualification	University
1972	BSc (hons) – First class	Monash University
1976	PhD	Monash University

Appointments

Current appointment

Year	Position	Location
Oct 2007- present	Director – Monash Immunology and Stem Cell Laboratories	Monash University - Clayton
2005 – Sept 2007	Deputy Director – MISCL	Monash University - Clayton
2003 - present	Director – Immunology Program	Australian Stem Cell Centre
2002 - present	Chief Scientific Officer	Norwood Immunology Ltd

1995 - 2007	Reader/Associate Professor – Professor	Department of Immunology, Monash University.

Previous appointments

Year	Position	Location
1989-1994	Senior Lecturer	Department of Pathology and Immunology, Monash University.
1988	Lecturer (tenured appointment)	Department of Pathology and Immunology, Monash University.
1985-1987	Lecturer (fixed term)	Department of Pathology and Immunology, Monash University.
1984	Research Fellow II	Department of Pathology and Immunology, Monash University.
1983	Research Fellow I	Department of Pathology and Immunology, Monash University.
1980-1982	Research Fellow, Tenured position	University of Innsbruck, Austria (Universitats Vertragassistent)
1978-1979	Research Fellow	University of Innsbruck, Austria (Universitats Vertragassistent)
1976-1977	Senior Tutor	Department of Pathology and Immunology, Monash University.

Professional awards and distinctions

2003 Australian Federal Government Centenary Medal for Service to International Medical Research and Undergraduate Teaching

2004 Australian Federal Government Business/Higher Education Round Table Award for Outstanding Achievement in Research and Development and Education and training.

1981 Preis der Stiftung der Hoechst Aktiengesellschaft, 1981
Effector mechanisms in spontaneous autoimmune thyroiditis in obese strain chickens. R.L. Boyd and G. Wick

1982 Von Basedow-Forschungspreis, 1982
Effector mechanisms in the spontaneous autoimmune thyroiditis of obese strain chickens : analysis of cytotoxic cells.
R.L. Boyd and G. Wick.

Publications since 1995

No.	Reference/Title of work	Citation information
1.	Hince, M. N., Sakkal, S., Vlahos, K., Dudakov, J.A., **Boyd, R.**,* and Chidgey, A. C.* (2007) The role of sex steroids and gonadectomy in the control of thymic involution. Cell. Immunol (in press)	IF: 1.709
2.	Chidgey, A.P, Dudakov, J.A., Seach, N., and **Boyd, R.L.**, (2007) Impact of niche aging on thymic regeneration and immune reconstitution. Semin Immunol, 19: 331-340	IF: 10.00

3.	Seach, N., Layton, D., Lim, D., Chidgey, A., and **Boyd, R.L.** (2007) Thymic generation and regeneration: A new paradigm for establishing clinical tolerance of stem cell-based therapies. Curr Opin Biotech. 18: 1-7	IF: 9.422
4.	Chidgey, A., **Boyd, R.,** Hugo, P. (2007) The Thymic Niche and Thymopoiesis. ENCYCLOPEDIA OF LIFE SCIENCES. John Wiley & Sons, Ltd: Chichester (2007)	NA
5.	Rossi, S.W., Chidgey, A.P., Parnell, S.M., Jenkinson, W.E., Scott, H.S., **Boyd, R.L.**, Jenkinson, E.J., and Anderson, G. (2007) Redefining epithelial progenitor potential in the developing thymus. Eur. J. Immunol. 37: 2411-2418.	IF: 4.772 CI: 1
6.	Gray, D.H.D., Tull, D., Ueno, T., Seach, N., Classon, B.J., Chidgey, A.C., McConville, M., and **Boyd, R.L.**, (2007) A Unique Thymic Fibroblast Population Revealed by the Monoclonal Antibody MTS-15. J. Immunol. 178: 4956-4965.	IF: 6.293 CI: 1
7.	Goldberg, G., Alpdogan, O., Muriglan, S.J., Hammett,M., Milton, M.K., Eng, J. M., Hubbard,V.M., Kochman, A., Willis, L.M., Greenberg, A.S., Tjoe, K.H., Sutherland, J.S., Chidgey, A., van den Brink, M. and Boyd, R.L. (2007). Enhanced Immune Reconstitution by Sex Steroid Ablation Following Allogeneic Hematopoietic Stem Cell Transplantation. J. Immunol. 178: 7473 – 7484.	IF: 6.293 CI: 1
8.	Ann P. Chidgey and **Richard L. Boyd** (2006) Stemming the tide of thymic ageing. Nature Immunol. 7(10):1013-6.	IF: 27.011
9.	Jeremy Millar, Jayne Sutherland, & **Richard Boyd** (2006) Alternative explanations for T-cell response to in-situ gene therapy for prostate cancer: In reply to Fugita et al (Int. J. Radiation Oncology Biol. Phys., Vol. 65, No. 1, pp. 84-90, 2006). Int. J. Radiation Oncology Biol. Phys., 66 (5): 1599.	IF: 4.556
10.	Goldberg, G., Alpdogan, O., Muriglan, S.J., Hammett,M., Milton, M.K., Eng, J. M., Hubbard,V.M., Kochman, A., Willis, L.M., Greenberg, A.S., Tjoe, K.H., Sutherland, J.S., Chidgey, A., van den Brink, M. and **Boyd, R.L.** (2007). Enhanced Immune Reconstitution by Sex Steroid Ablation Following Allogeneic Hematopoietic Stem Cell Transplantation. J. Immunol. (in press, Ms. No. 06-2215).)	IF: 6.387
11.	Daniel H.D. Gray, Natalie Seach, Tomoo Ueno, Morag Milton, Adrian Liston, Andrew M. Lew, Christopher C. Goodnow, **Richard L. Boyd** (2006) Developmental kinetics, turnover and stimulatory capacity of thymic epithelial cells. Blood 108(12):3777-85	IF: 10.131 CI: 15
12.	Nijhof JG. Braun KM. Giangreco A. van Pelt C. Kawamoto H. **Boyd RL.** Willemze R. Mullenders LH. Watt FM. de Gruijl FR. van Ewijk W. (2006) The cell-surface marker MTS24 identifies a novel population of follicular keratinocytes with characteristics of progenitor cells. Development. 133(15):3027-37.	IF: 7.603 CI: 8
13.	Uldrich, A.P., Berzins, S.P., Malin, M.A., Bouillet, P., Strasser, A., Smyth, M.J., **Boyd, R.L.*** and Godfrey, D.I.* (2006). Antigen challenge inhibits thymic emigration. J. Immunol. 176: 4553-4561 (* equal contribution)	IF: 6.387 CI: 1

14.	Kurobe, H., Liu, C., Ueno, T., Saito, F., Ohigashi, I., Seach, N., Arakaki, R., Hayashi, Y., Kitagawa, T., Lipp, M., **Boyd, R.L.**, and Takahama,Y. (2006) CCR7-dependent cortex to medulla migration of positively selected thymocytes is dispensable for T-cell maturation and thymic export but is essential for establishing central tolerance. Immunity. 24(2):165-77.	IF: 15.156 CI: 20
15.	Alpdogan O, Hubbard VM, Smith OM, Patel N, Lu SX, Goldberg GL, Gray DH, Feinman J, Kochman AA, Eng JM, Muriglan SJ, Suh D, **Boyd RL**, van den Brink MR. (2006) Keratinocyte Growth Factor (KGF) Is Required For Post-Natal Thymic Regeneration. Blood, 107(6):2453-60.	IF: 10.131 CI: 15
16.	Brodnicki, T.C., Fletcher, A.L., Pellicci, D.G., Berzin S.P., McClive, P., Quirk, F.,Webster1, K.E., Scott, H.S., **Boyd, R.L.**, Godfrey, D.I., Morahan,G. (2006) Localization of Idd11 Is Not Associated with Thymus and NKT Cell Abnormalities in NOD Mice. Diabetes. 54(12):3453-7	IF: 8.028 CI: 0
17.	Kennedy, C., Krejany, E., Young, L., Awad, M.M., **Boyd, R.L.**, Emmins, J.J., Lyras, D. and Rood, J.I. (2005) The α toxin of Clostridium septicum is essential for virulence, Mol Micro. 57(5):1357-66.	IF: 6.203 CI: 0
18.	Goldberg, G.L., Sutherland, J.S., Hammet, M.V., Milton, M.K., Heng, T.S.P., Chidgey, A.P., **Boyd, R.L.,** (2005) Sex Steroid Ablation Enhances Lymphoid Recovery Following Autologous Haematopoietic Stem Cell Transplantation. Transplantation. 80(11):1604-1613	IF: 3.879 CI: 0
19.	Tracy S.P. Heng, Gabrielle. L. Goldberg, Daniel H.D. Gray, Jayne S. Sutherland, Ann P. Chidgey and **Richard L. Boyd**. (2005) Effects of castration on thymocyte development in two different models of thymic involution. J. Immunol., 175: 2982-2993	IF: 6.387 CI: 1
20.	Sutherland, J.S., Goldberg, G.L., Hammett, M.V., Uldrich,, A.P., Berzins, S.P.,Heng, T.S., Blazar, B.R., Millar, J.L., Malin, M.A., Chidgey, A.P., and **Boyd, R.L.** (2005). Activation of thymic regeneration in mice and humans following androgen blockade. J. Immunol, 175(4):2741-53	IF: 6.387 CI: 3
21.	Liston, A., Lesage, S., Gray, D.H.D., **Boyd, R.L.** and Goodnow, C.H. (2005).Genetic lesions in T-cell tolerance and thresholds for autoimmunity. Immunol Rev, **204**: 87 – 101.	IF: 8.420
22.	Gray, D.H.D., Ueno,T., Chidgey. A.P., Goldberg,G., Takahama, Y. amd **Boyd, R.L.** (2005). Controlling the thymic microenvironment. Curr Opin Immunol 17: 137-143	IF: 9.103 CI: 13
23.	Liston A., Lesage, S., Gray, D.H.D., O'Reilly, L.A., Fahrer, A.M., **Boyd, R.L.**, Wilson, J., Baxter, A.G., Gallo,E.M., Crabtree, G.R., Peng, K., Wilson, S.R. and Goodnow, C.C. (2004). Generalized resistance to thymic deletion in the NOD mouse: A polygenic trait characterised by defective induction of Bim. Immunity **21**(6): 817 –830.	IF: 15.156 CI: 25
24.	Liston A., Gray,, D.H.D., Lesage, S., Fletcher, A.L., Wilson, J., Webster, K.E., Scott, H.S., **Boyd, R.L.** , Peltonen, L., and Goodnow,C.C.(2004). Gene Dosage-limiting Role of Aire in Thymic Expression, Clonal Deletion, and Organ-specific Autoimmunity J. Exp. Med. **200**(8): 1015-102.	IF: 13.965 CI: 35
25.	Van den Brink, M., Alpdogan, O. and **Boyd, R.** (2004). Strategies to enhance T cell reconstitution in immunocompromised patients. Nature Rev. Immunol, 4(11): 856- 867.	IF: 30.458 CI: 17
26.	Ueno T. Saito F. Gray DH. Kuse S. Hieshima K. Nakano H. Kakiuchi T. Lipp M., **Boyd RL**. Takahama Y. (2004) CCR7 signals are essential for cortex-medulla migration of developing thymocytes, J Exp Med. 200(4):493-505.	IF: 13.965 CI: 26

27.	Malcolm, KM, Gill, J, Leggatt, G.R., **Boyd, R.**, Lambert, P. and Frazer, I.H (2003). Expression of the HPV16E7 oncoprotein by thymic epithelium is accompanied by disrupted T cell maturation and a failure of the thymus to involute with age. Clin. Dev. Immunol 10: 91-103.	IF: 8.420
28.	Gill, J., Malin,M., Sutherland,J., Gray,D., Goldberg,G., Hollander,G., and **Boyd, R.L.** (2003) Thymic generation and regeneration. Immunol Rev. 195: 28-50.	IF: 8.420 CI: 28
29.	Balciunaite, G., Keller, MP., Balciunaite,E., Piali, L., Zuklys,S., Yves D. Mathieu,Y.D., Gill, J., **Boyd,R.**, Sussman, D.J., and Holländer, G.(2002). Wnt glycoproteins regulate expression of FoxN1, the gene defective in nude mice. Nature Immunol 3, 1102 - 1108.	IF: 27.011 CI: 38
30.	Flentjar, N.J., Crack, P.J., **Boyd,R.L.**, Malin,M., de Haan,J.BZ., Hertzog, P., Kola,I., and Iannello,R. (2002). Mice lacking glutathione peroxidase-1 activity show increased tunel staining and an accelerated inflammatory response in brain following a cold-induced injury. Exp Neurol 177: 9-20.	IF: 3.767 CI: 9
31.	Berzins SP, Uldrich AP, Sutherland JS, Gill J, Miller JF, Godfrey DI, **Boyd RL**. (2002). Thymic regeneration: teaching an old immune system new tricks. Trends Mol Med. 10: 469-76.	IF: 5.505 CI: 26
32.	Gill, J., Malin, M., Holländer, G.A., and **Boyd, R.L.** (2002). Generation of a complete thymic microenvironment by MTS 24+ thymic epithelial cells. Nature Immunol. 3: 635 – 642.	IF: 27.011 CI: 57
33.	Blackburn, C. C., Manley, N.R., Palmer, D.B., **Boyd, R.L.** , Anderson,G., and Ritter, M.A. (2002). One for all and all for one: thymic epithelial stem cells and regeneration. Trends Immunol. **23**: 391-395	IF: 10.174 CI: 26
34.	Okada,T., Lian, Z-X., Hsu, T., Naiki, M., Ansari, A., Robinson, D., Kung, H-J., **Boyd, R.** and Gershwin, M.E. (2002). Elevated C-met in thymic dendritic cells of New Zealand Black mice. Dev. Immunol. 9: 29-34.	IF: NA
35.	Zammit,D., Berzins, S., Gill,J., Barnett, L., Koentgen, F., Lambert, G.W., Harvey,R.P., **Boyd, R.L.** and Classon, B.J. (2002). Essential role for the lymphostromal plasma membrane Ly6 superfamily molecule Thymic Shared Antigen 1 in development of the embryonic adrenal gland. Molec. Cell Biol. **22**: 946-952.	IF: 7.093 CI: NA
36.	Ueno, T., Hara,K., Swope Willis,M., Malin,M, Höpken,U.E., Gray,D., Matsushima,K., Lipp,M., Springer,T., **Boyd,R.**, Yoshie,O., and Takahama,Y. (2002).Role for CCR7 ligands in the emigration of newly generated T lymphocytes from the neonatal thymus. Immunity 16: 205 - 218.	IF: 15.156 CI: 58
37.	Gray, D.H.D., Chidgey, A.P. and **Boyd, R.L.** (2001). Analysis of thymic stromal cell populations using flow cytometry. J. Immunol. Methods **260**:15-28.	IF: 2.572 CI: 27
38.	Awad, M.M., Ellemor, D.M., Boyd,,R.L., Emmins, J.J. and Rood J.I., (2001). Synergistic effects of α-toxin and perfringolysin O in Clostridium perfringens-mediated gas gangrene. Infect Immun 69(12): 7904-7910.	IF: 3.933 CI: 12
39.	Chidgey, A.P. and **Boyd, R.L.** (2001) Thymic stromal cells and positive selection. A.P.M.I.S **109**: 481-492.	IF: 2.127 CI: 10
40.	Godfrey DI, Purton JF, **Boyd RL,** Cole TJ. (2001). Glucocorticoids and the thymus: the view from the middle of the road. Trends Immunol. **22**:243.	IF: 10.174 CI: 6

41.	Godfrey, D.I., Purton, J.F., **Boyd, R.L.** , Cole, T.J. (2000). Stress-free T cell development: glucocorticoids are not obligatory. Immunol. Today 21: (12) 606 – 611.	IF: 10.174 (now 'Trends in Immunology') CI: 32
42.	**Boyd, R.L.** and Chidgey, A.P. (2000) T cell development and function – a downunder experience. Immunol. Today **21**: 472 – 474.	IF: 10.174 (now 'Trends in Immunology') CI: 6
43.	Purton, J., **Boyd, R.**, Cole, T., and Godfrey, D. (2000). Intrathymic T cell development and selection proceeds normally in the absence of glucocorticoid receptor signaling. Immunity 13: 179-186.	IF: 15.156 CI:50
44.	Awad, M.M., Ellemor, D.M., Bryant, A.E., Matsushita, O., **Boyd, R.L.** , Stevens, D.L., Emmins, J.J., Rood, J.I. (2000). Construction and virulence testing of a collagenase mutant of Clostridium perfringens. Microbiol. Pathogenesis **28**: 107 – 117.	IF: 2.303 CI: 4
45.	Lechner O, Wiegers GJ, Oliveira-Dos-Santos AJ, Dietrich H, Recheis H, Waterman M, **Boyd R**, Wick G. (2000). Glucocorticoid production in the murine thymus. Eur J Immunol 30:337-346.	IF: 4.876 CI: 43
46.	Taguchi, N., Hashimotot, Y., Naiki, M., Farr, A.G., **Boyd, R.L.** , Ansari, A.A., Shultz,L.D., Kotzin, B.L., Dorshkind, K., Ikehara, S., and Gershwin, M.E. (1999). Abnormal thymic expression of epithelial cell adhesion molecule (Epcam) in New Zealand Black (NZB) mice. J. Autoimmunity **13**: 393 – 404.	IF: 2.491 CI: 2
47.	Takeoka, Y., Taguchi, N., Shultz, L., **Boyd, R.L.** , Naiki, M., Ansari, A.A. and Gershwin, M.E. (1999).Apoptosis and the thymic microenvironment in murine lupus. J. Autoimmunity **13**: 325 – 334.	IF: 2.491 CI: 5
48.	Takeoka Y, Taguchi N, Kotzin BL, Bennett S, Vyse TJ, **Boyd RL**, Naiki M, Konishi J, Ansari AA, Shultz LD, Gershwin ME. (1999). Thymic microenvironment and NZB mice: the abnormal thymic microenvironment of New Zealand mice correlates with immunopathology. Clin Immunol **3** 388 – 398.	IF: 2.491 CI: 8
49.	Berzins, S., Godfrey, D.I., Miller, J.F.A.P. and **Boyd, R.L.** (1999) A central role for thymic emigrants in peripheral T cell homeostasis. Proc. Nat. Acad. Sci. 96: 9787 – 9791.	IF: 10.231 CI: 61
50.	Naquet,P., Naspetti,M. and **Boyd, R.L.** (1999). Development, organization and function of thymic medulla in normal, immunodeficient or autoimmune mice. Seminars in Immunology, **11**: 47 – 56.	IF: 8.922 CI: 41
51.	Katevuo, K., Imhof, B., **Boyd, R.L.** , Bean, A., Chidgey, A., Dunon, D., Goebel, T. and Vainio, O. (1999) ChT1, an IgSF molecule required for T cell differentiation. J. Immunol 162: 5685 – 5694.	IF: 6.387 CI: 17
52.	Berzins, S., Davey, G.M., Randle-Barrett, E.S., Malin, M. and **Boyd, R.L.** TSA-2: A novel T cell marker associated with differentiation and activation. J. Immunol. 162: 5119 – 5126.	IF: 6.387 CI: 4
53.	Ellemor, D., Baird, R., Awad, M., Rood, J., Emmins, J. and **Boyd, R.L.** (1999) Use of genetically manipulated strains of Clostridium perfringens reveals both alpha-toxin and theta toxin are required for vascular leukostasis to occur in experimental gas gangrene Infect Immun 67: 4902 – 4907.	IF: 3.933 CI: 20
54.	Williams, G.S., Malin, M., Vremec,D., Chang,C-H., **Boyd, R.L.** , Benoist, C. and Mathis, D. (1998). Mice lacking the transcription factor CIITA- a second look. Int. Immunol. 10: 1957 – 1967.	IF: 3.317 CI: 57

55.	**Boyd, R.L.** , Chidgey, A.P., Wallace, V.A., Hakem, A., Mittrucker, H-W., Bouchard, D., Kozieradzki, I., Ionescu, J., Timms, E., Kishihara, K., Ong, C.J., Chui, D., Marth, J.D., Mak, T.W. and Penninger, J. M. (1998) : Receptor- specific allelic exclusion of TCR Vα chains during development. J. Immunol. 161: 1718 – 1727.	IF: 6.387 CI: 12
56.	Chidgey, A.P. & **Boyd, R.L.** (1998) : Positive selection of low responsive potentially autoreactive T cells induced by high avidity, non-deleting interactions. Int. Immunol 10: 999-1008.	IF: 3.317 CI: 12
57.	Berzins, S.P., **Boyd, R.L.** and Miler, J.F.A.P. (1998) The role of the thymus and recent thymic migrants in the maintenance of the adult peripheral lymphocyte pool. J. Exp. Med. **187**: 1839 – 1848.	IF: 13.965 CI: 119
58.	Classon, B.J. and **Boyd, R.L.** (1998). Thymic shared Antigen-1 (TSA-1): A lymphostromal cell membrane Ly6 superfamily molecule with a putative role in cellular adhesion. Dev. Immunol 6: 149 – 156.	IF: NA CI: NA
59.	Chidgey, A.P., Pircher, H., MacDonald, H.R. & **Boyd, R.L.** (1998) An adult thymic stromal cell suspension model for in vitro positive selection shows multiple effects of an agonist peptide. Dev. Immunol 6: 157-170	IF: NA
60.	Penninger, J.M., Sirard, C., Mittrucker, H-W., Chidgey, A.P., Kozieradzki, I., Hakem, A., Matsuyama, T., Kimura, T., Timms, E., **Boyd, R.L.** , Taniguchi, T., & Mak, T.W. (1997) The interferon regulatory transcription factor IRF-1 controls positive and negative selection of CD8+ thymocytes. Immunity 7: 243-254.	IF: 15.156 CI: 50
61.	Takeoa,Y., Naiki,M., **Boyd, R.L.** , Yago, H., Suehiro, S.and Gershwin, M.E. (1997). Neurotropin improves the thymic microenvironment and nephritis in (NZBxNZW) F1 mice. Int. J. Immunotherapy XIII (1/2) 45 - 54).	IF: NA CI: NA
62.	Takeoka,Y., Chen,S-Y., **Boyd, R.L.** , Tsuneyama,K., Taguchi,N., Morita,S., Yago,H., Suehiro, S., Ansari, A., Schultz, L.D. and Gershwin, M.E. (1997). A comparative analysis of the murine thymic microenvironment in normal, autoimmune and immunodeficiency states. Dev. Immunol. 5: 79 - 89.	IF: NA CI: 11
63.	Chidgey, A. and **Boyd, R.L.** (1997). Agonist peptide modulates T cell selection thresholds through qualitative and quantitative shifts in CD8 co-receptor expression. International Immunology, 9: 1527 - 1536.	IF: 3.317 CI: 31
64.	Chen, S-Y., Takeoka, Y., Pike-Nobile,L., Ansari,T., **Boyd, R.L.** and Gershwin, M.E. (1997). Autoantibody production and cytokine profiles of MHC class I (β2-microglobulin) gene-deleted New Zealand Black (NZB) mice. Clin. Immunol. Immunopathol. 84: 318 327.	IF: NA CI: 7
65.	Jeurissen, S.H.M., Claassen, E. and **Boyd, R.L.** (1997). Immunohistochemistry in the analysis of lymphoid organs and their function. Methods in Avian Immunolgy 2235 - 2245.	IF: NA
66.	Siatskas, C., Lowenthal, J. and **Boyd, R.L.** (1997). Avian Cytokines. Methods in Avian Immunolgy. 2257 - 2268.	IF: NA CI: NA
67.	Hala, K., Malin, G., Dietrich, H., Loesch, U., Boeck, G., Wolf, H., Kaspers,B., Geryk, J., Falk, M., Wick, G. and **Boyd, R.L.** (1996). Analysis of the initiation period of spontaneous autoimmune thyroiditis (SAT) in Obese strain (OS) chickens. J.Autoimmunity 9: 129 - 138.	IF: 2.491 CI: 13
68.	Penit, C., Lucas, B., Vasseur, F., Rieker, T. and **Boyd, R.L.** (1996). Thymic medulla epithelial cells acquire specific markers by post-mitotic maturation. Dev.Immunol. 5: 25 - 36.	IF: NA CI: 17

69.	Chen, S-Y., Takeoka, Y., Ansari, T., **Boyd, R.L.** , Klinman,D. and Gershwin, E. (1996). The natural history of disease expression in CD4 and CD8 gene deleted New Zealand Black mice. J.Immunol. 157: 2676 - 2684.	IF: 6.387 CI: 17
70.	Siatskas, C. McWaters, P.G., Digby, M. Lowenthal, J.W. and **Boyd, R.L.** (1996). In vitro characterisation of a novel avian haemopoietic growth factor derived from stromal cells. Dev.Comp.Immunol. 20: 139 – 156.	IF: 3.261 CI: 2
71.	Blackburn, C.C., Augustine, C.L., Lui, R., Harvey, R.P., Malin M.A., **Boyd, R.L.**, Miller, J.F.A.P. and Morahan, G. (1996). The nu gene acts cell-autonomously and is required for differentiation of thymic epithelial progenitors Proc. Natl. Acad. Sci.. **93**: 5742 - 5746.	IF: 10.231 CI: 47
72.	**Boyd, R.L.** and Siatskas,C. (1996). Improvement of chicken disease resistance by haemopoietic cytokines. Proc. Australian Poultry Science Symposium.	
73.	Takeoka,Y., Chen,S-Y., Yago, H., **Boyd, R.L.** , Suehiro,S., Shultz, L.D., Ansari, T. and Gershwin, M.E. (1996). The murine thymic microenvironment changes with age. Int. Archs. Allergy Appl. Immunol. 111: 5 - 12.	IF: 2.201 CI: 21
74.	Obranovich, T.D. and **Boyd, R.L.** (1996) A bursal stromal derived cytokine induces proliferation of MHC class II bearing cells. Dev. Comp. Immunol. 20: 61 - 75.	IF: 3.261 CI: 4
75.	Davey, G.D., Tucek-Szabo,C.L. and **Boyd, R.L.** (1996). Characterisation of the AKR thymic microenvironment and its influence on thymocyte differentiation and lymphoma development. Leukaemia Research 20: 853 – 866	IF: 2.372 CI: 2
76.	Takeoka, Y., Whitmer, K.J., Chen, S-Y., Ansari, T., **Boyd, R.L.**, Schultz, L.D., Suehiro, S. and Gershwin, M.E. (1995). Thymic epithelial cell abnormalities in (NZB x H-2^u) F1 mice. Clin. Immunol. Immunopathol. **76**: 297 - 307.	IF: NA CI: 13
77.	Duncan, M., Berman, B., Van de Water, J. **Boyd, R.L.** , Wick, G. and Gershwin, M.E.(1995).Mononuclear cells isolated from fibrotic skin lesions in avian scleroderma constitutively produce fibroblast-activating cytokines and immunoglobulin M .Int. Archs. Allergy Appl. Immunol. 107: 519 - 526.	IF: 2.201 CI: 3
78.	Takeoka, Y., Yoshida, S.H., Morita, S., Suehiro, S., **Boyd, R.L.** and Gershwin, M.E.(1995). Influence of neurotropin on thymic microenvironmental abnormalities of NZB mice. Int.J. Immunotherapy xi: 49 - 56.	IF: NA CI: 1
79.	Takeoka, Y., Yoshida, S.H., van de Water, J., **Boyd, R.L.** , Suehiro, S., Ansari,T., and Gershwin, E. (1995) Thymic microenvironmental abnormalities in MRL/MP-lpr/lpr, BXSB/MpJ Yaa and C3H/HeJ - gld / gld mice. J. Autoimmunity 8: 145 – 161	IF: 2.491 CI: 14
80.	Randle-Barrett, E.S. and **Boyd, R.L.** (1995). Thymic microenvironment and lymphoid response to sublethal irradiation. Dev. Immunol. 4: 101 - 116.	IF: NA CI: 5
BOOK CHAPTERS		
1.	Gray, D.H.D., Gill, J.W., Trounson, A.O., and **Boyd, R.L.** (2004). Thymus and tolerance in transplantation. Handbook of Stem Cells, Volume 1, Elsevier, Academic Press. 675- 686	
2.	Hugo, P and **Boyd, R.** (2002). "Thymus".Encyclopeaedia of Life Sciences.p1-11	
3.	**Boyd, R.L.** (1998). Stromal cells. Encyclopaedia of Immunology 2233 – 2238	

NOTE: A total of 122 papers and book chapters were published prior to 1995. See Appendix 1.

Research funding since 1995

No	Title of grant	Funding body	Year	Successful	Individual contribution %	Total value of grant ($)
1	Australia – China Centre for Excellence in Stem Cell Research. PI, Professor Richard Boyd, Monash Immunology and Stem Cell Laboratories; Co-PI Professor Lingsong Li Peking University Stem Cell Research Centre	Australian Federal Government (DEST)	2007-2010	YES	15	$450,000 plus $450,000 cash/in kind from Monash
2	Innovative stem cell-based strategies to establish immune tolerance and tissue repair	NH&MRC (Program grant)	2007-2011	YES	30	$5,338,070
3	Reversal of multiple sclerosis-like disease by stem cell-based strategies	National Multiple Sclerosis Society, New York	2007-2009	YES	20	Approx $360,000 US
4	Novel generic vaccine approaches applied for the prevention of hepatitis C and influenza virus infections	NH&MRC (Project grant)	2007-2009	YES	20	$376,875
5	Therapeutic potential of fetal membrane derived stem cells in the treatment of chronic lung diseases	Monash University Strategic (Collaborative) grant	2007	YES	15	$60,000
6	Rebuilding Immunity for Survival – Immune Modulation Program	Australian Stem Cell Centre	2006 2007	YES	80	~$1mil ~$1mil
7	Research and development and pre-clinical and clinical trials on the effectiveness of LHRH agonists on rejuvenating T cell-based immune responses.	Norwood Immunology	2006 2005 2004 2003 2002 2001	YES	80	~$500k ~$1.7 mil ~$1.7 mil ~$1.3 mil ~$904k ~$478k
8	Rebuilding Health for survival	National Institutes for Health (USA) CA100265-01 Boyd research-based Phase II randomised placebo controlled FDA approved clinical trial.	2004 2005 2006 2007	YES	10	No direct funds to lab
9	Cellular molecular and functional analysis of thymic epithelial precursor cells	National Institutes for Health (USA) RO1. AI 57477	2004 2005 2006 2007	YES	10	$250,000 p.a. No direct funds to lab
10	Strategies To Prevent and Repair Thymic Microenvironment	National Institutes for Health, (USA) RO1	2004 2005 2006 2007	YES	10	$250,000 p.a. No direct funds to lab

11	The use of Neural Stem Cells as a Therapeutic Tool in Neurological Disorders	Baker Foundation	2006 2007 2008	YES	30	$300k $300k $300k
12	Molecular mechanism of the thymus organogenesis workshops	Australian Government Department of Education, Science and Training. (International Science Linkages Strategic Policy)(SP0500002)	2005 2006	YES	100	$45k total
13	Pathogenesis of clostridial myonecrosis	NH&MRC (Project) (now NH&MRC Program Grant ID 284214 for 5 years, J.Rood principal investigator. Boyd associated research ~$120,000 p.a.)	2003	YES	10	$130k
14	The generation, fate and functional potential of recent thymic emigrants	NH&MRC (Project)	2000 2001 2002	YES	50	$105,231 $103,705 $103,705
15	The cellular and molecular basis to the paradox of positive versus negative T cell selection.	NH&MRC (Project)	2000 2001 2002	YES	80	$88,327 $93,142 $94,223
16	The molecular basis to the development and function of the thymic microenvironment.	NH&MRC (Project)	2001 2002 2003	YES	80	$75,000 $75,000 $75,000
17	Differential gene expression analysis to elucidate the mechanisms of thymic development.	NH&MRC (Project)	1998 1999 2000	YES	50	$47,325 $50,083 $52,882
18	Evaluation of Diver Health	Victorian Fisheries	1997 1998	YES	50	$15,000
19	Molecular Studies of Lymphostromal Molecules Important in Thymopoiesis and T Cell Function	NH&MRC (Project)	1997 1998 1999	YES	80	$90,495.49 $93,343.60 $94,333.89
20	Cellular and Molecular Basis to Intrathymic Positive Selection	NH&MRC (Project)	1997 1998 1999	YES	80	$62,104.22 $63,714.17 $65, 321.81
21	Functional Analysis of the Thymic Microenvironment	NH&MRC (Project)	1997 1998 1999	YES		$58,040.22 $59,650.17 $61, 257.81
22	Generation of Antigen-restricted Human T cells in vitro	Alfred HealthCare Group	1996 1997	YES	20	$20,000 pa
23	The Thymic Microenvironment in NZB mice.	National Institutes for Health, Bethesda	1996 1997 1998	YES	20	~$110,000 p.a.

24	Development of an in vitro assay for positive selection (Site visit to Ontario Cancer Institute, AMGEN, Toronto)	Department of Industry, Technology and Regional Development.	1996	YES	50	$7,000
25	Improvement of Chicken Disease Resistance by Cytokines	Australian Chicken Meat Research Council	1995 1996 1997	YES	100	$30,000 $30,000 $30,000
26	Molecular analysis of novel lymphostromal antigens regulating thymopoiesis.	NH&MRC (Project)	1995 1996 1997	YES	80	$29,540 $30, 012 $30, 012
27	Immunoregulatory properties of whey proteins	Dairy Research Development Council.	1995 1996 1997	YES	100	$29, 500 $29, 500 $29, 500
28	Immunoregulation in Avian Scleroderma	National Institutes of Health, USA	1993 1994 1995 1996	YES	20	$121,629 $121,629 $121,629 $121,629

Assessor of Competitive Grants for:	
No.	**Funding body (i.e. ARC / NHMRC / Other)**
1	NH&MRC, Australia
2	Australian Research Council (ARC)
3	Australian Stem Cell Center
4	Anti-Cancer Councils of Victoria, New South Wales, and Queensland
5	Human Frontier Science Program
6	MRC United Kingdom
7	National Institutes of Health, Bethesda
8	Alfred Hospital, Melbourne
9	New Zealand HRC
10	Raine Foundation, Western Australia
11	USA-Israel Binational Science Foundation
12	Diabetes Vaccine Development Centre
TOTAL	**Approximately 5- grant reviews per year**

Research Supervision	
Completed Research Students - PhD	**Supervisory Role**
1. Gabrielle Goldberg (2006) "Sex steroid ablation enhances immune reconstitution following severe immunodepletion"	MAIN
2. Tamara Etto (2006) Generation of minor histocompatibility antigen specific T cells using various antigen sources for adoptive immunotherapy.	ASSOCIATE
3. Kate Ward (2006) Key steps involved in the generation of antigen specific T cells for adaptive immunotherapy.	ASSOCIATE
4. Tracy Heng (2005) "Kinetics and functional impact of castration-induced thymic regeneration."	MAIN
5. Adam Uldrich (2004) "The effect of antigen encounter on T cell export, recent thymic emigrants, and NKT cells."	MAIN
6. David Zammit (2003) "Development and Immunological characterisation of mice deficient in Thymic Shared Antigen-1."	MAIN

7. Bryce Feltis (2003) "Eosinophils and eosinophilic chemokines in asthma and the effect of inhaled corticosteroids."	ASSOCIATE
8. Daniel Gray (2003) "Thymic stromal cells: Population dynamics an their role in thymopoiesis."	JOINT/CO
9. Jason Gill (2002) "Progenitor cells of the thymic epithelium, and factors influencing thymic development."	MAIN
10. Jayne Sutherland (2001) "Enhancement of thymopoiesis and cell-mediated immunity through sex steroid blockade."	MAIN
11. Stuart Berzins (2000) "The development of thymic emigrants and their influence on the peripheral T cell pool."	MAIN
12. Christopher Siatskas (1998) "Identification and functional characterisation of chicken cytokines."	MAIN
13. Ann Chidgey (1998) "The cellular and molecular basis to thymic positive selection."	MAIN
14. Oskar Lechner (1997) "Endogenous glucocorticoids in autoimmune disease and in the thymus."	MAIN
15. Marina Katerelos (1997) "Isolation and characterisation of a cyclosporin A-downregulated gene: CsA-19."	MAIN
16. John Emmins (1996) "Immunological and genetic analysis of Koalas."	MAIN
17. Gayle Davey (1995) Characterisation of a lymphostromal molecule involved in normal and leukaemic thymopoiesis."	MAIN
18. Marilina Masciantonio (1995). "Characterisation of anti-thymic stromal mAbs and the antigens they detect."	MAIN
19. Elise Randle (1994). "Functional evaluation of the lymphostromal molecule TSA-1."	MAIN
20. Andrew Bean (1993). "Chicken Lymphocyte and Stromal Cell-associated Antigens: A phenotypic and Functional Analysis."	MAIN
21. Tania Obranovich (1993). "The Bursal Microenvironment: Production and Phenotypic and Functional Characterisation of Stromal Cell Lines."	MAIN
22. Natalie J. Davidson (1992). "Phenotypic and Functional Analysis of the Chicken Thymic Microenvironment."	MAIN
23. Carolyn L. Tucek (1991) "Analysis of Antigens Present on Both Mouse Thymic Stromal Cells and Thymocytes: Relevance to Thymopoiesis".	MAIN
24. Trevor J. Wilson (1990) "Chicken Thymic and Bursal Stromal Cells: Characterisation, Ontogeny and Alterations in Immunodeficiency and Autoimmunity."	MAIN
25. Dale I. Godfrey (1990) "Thymic Stromal Microenvironments: Characterisation, Modulation and Functional Analysis."	MAIN
26. Gary A.Waanders, (1990) "Modulation of T Cell Differentiation by Cytokine and Monoclonal Antibody Treatment of Fetal Thymic Organ Culture."	MAIN
27. Anthony Eglezos (1989) "Neurogenic Modulation of the Immune Response."	MAIN
28. Jeanette A.Tratkiewicz (1988) "Cytotoxic Cells in Acute Leukaemia: Diagnostic and Therapeutic Potential."	JOINT/CO
29. Helen C. Ramm (1989) "Chicken B Lymphocyte Development: Ontogeny, Bursal Microenvironment and Alterations in Infectious Bursal Disease."	MAIN
30. Geoffrey W. Dandie (1988) "Antigenic Promotion, Antigenic Competition and Immunity." Co-supervised with Dr D. Poskitt.	JOINT/CO

31. David J. Izon (1989) "The Role of Thymic Stromal Cells in Lymphopoiesis and Myelopoiesis".	MAIN
32. Ian G. Barr (1984) "Leucocyte Differentiation and Surface Markers in Man and Mouse."	JOINT/CO
Completed MSc	
33. Maree Hammett (2002) "T cells and the Graft-versus leukaemia phenomenon."	JOINT/CO
34. Elizabeth O'Flaherty (1994) "Assessment of bone marrow stromal cell function from patients with leukaemia."	JOINT/CO
Current Research Students - PhD	
35. Linda Kenins	MAIN
36. Anne Fletcher	MAIN
37. Jarrod Dudakov	MAIN
38. Samy Sakal	MAIN
39. Jessica Reiseger	MAIN
40. Adele Barnard	MAIN
41. Katerina Vlahos	MAIN
42. Natalie Seach	MAIN
43. Melanie Hince	MAIN
44. Joanna Lim	JOINT
45. Sarah Snelgrove	JOINT
46. Chew –Li Soh	JOINT
47. Oanh Ngyen	ASSOCIATE

Honours Students (Past)		
Year	**Course**	**Student**
2006/7	BMSc (Hons)	Danika Khong
2006/7	BSc (Hons)	Harry Banaharis
2006	BMSc (Hons)	Mirabelle Ho
2006	BMSc (Hons)	Jordan Kane
2006	BSc (Hons)	Tamara Lowen
2005	BSc (Hons)	Melanie Hince
2005	BMSci (Hons)	Timothy Williams
2004	BSc (Hons)	Marc Jurblum
2003	BSc (Hons)	Jessica Porter
2003	BSc (Hons)	Natalie Seach
2003	BSc (Hons)	Katerina Vlahos
2003	BSc (Hons)	Jarrod Dudakov
2002	BSc (Hons)	Samantha Harris
2002	BSc (Hons)	Lauren Young
2002	BSc (Hons)	Anne Fletcher
2001	BSc (Hons)	Elizabeth Chapman
2001	BSc (Hons)	Alexander Barker
2001	BSc (Hons)	Samy Sakkal
2000	BSc (Hons)	Gerard Tarulli
2000	BSc (Hons)	Tracy Heng
1999	BSc (Hons)	Adam Uldrich
1999	BSc (Hons)	Douglas Liddicoat
1999	BSc (Hons)	Gabrielle Goldberg
1998	BSc (Hons)	Daniel Pellici
1998	BSc (Hons)	Morag Milton
1998	BSc (Hons)	Daniel Gray
1997	BSc (Hons)	David Zammit
1997	BSc (Hons)	Maree Hammett
1997	GDip (Imm)	Bryce Feltis
1997	BMSci(Hons)	Oskar Lechner
1997	BSc (Hons)	Rebecca Baird
1996	BSc (Hons)	Jayne Sutherland
1996	BSc (Hons)	Jason Gill
1996	BSc (Hons)	Darren Ellemor
1995	BMSci (Hons)	Sanjay Swaminathan
1995	Gdip (Imm)	Hieng Lim

1994	BSc (Hons)	Julian Pearson
1993	BSc (Hons)	Melinda Price
1993	BSc (Hons)	Ann Chidgey
1992	BSc (Hons)	Stuart Fraser
1991	BSc (Hons)	Mirey Lahoud
1990	BSc (Hons)	Christopher Siatskas
1990	BSc (Hons)	Elise Randle
1989	BSc (Hons)	Uta Bauer
1989	BSc (Hons)	Belinda Gourlay
1989	MSc (Prelim)	Mark Malin
1987	BSc (Hons)	Frank Sommerfeld
1987	BSc (Hons)	Carolyn Tucek
1987	BSc (Hons)	Sara Gipton
1987	BSc (Hons)	Marilina Masciantonio
1987	BSc (Hons)	Natalie Davidson
1986	BSc (Hons)	Dale Godfrey
1986	BSc (Hons)	Anthony Eglezos
1986	BSc (Hons)	Andrew Bean
1985	BMSci (Hons)	Georg Oberhuber
1985	BSc (Hons)	Gary Waanders
1985	BSc (Hons)	Kathy Mitrangas
1985	BSc (Hons)	Lisa Bonadonna
1985	BSc (Hons)	Paul Bello
1984	BSc (Hons)	Nicholas Samaras
1984	BSc (Hons)	Dianne Young
1984	BSc (Hons)	Helen Ramm
1983	BSc (Hons)	Trevor Wilson
1983	BSc (Hons)	David Izon
1983	BSc (Hons)	Brendan Classon
1977	BSc (Hons)	Gregory Woods
1977	BSc (Hons)	Ian G Barr

Outline of teaching and unit improvement and innovation

Unit (Subject) code	Unit Name	Sessions (Lecture, tutorial, practical etc.)	No. of students	Years taught	Improvement/innovation
IMM3011	Immunology	Lectures and Practical Classes	50-100 per year	1976-present	Co-founded Immunology as a Science subject. Involved in the continual evolution of the the subject – lecture content, practical classes, evaluations.
IMM4000	Immunology – honours subject	Research Projects including theory component	15-25 per year	1976-present	Co-founder of subject. Involved in the continual evolution of the subject, including acting as co-ordinator for 8 of 16 years since 1990. Organised extensive overhaul of course examination.

Editorial and Scientific Appraisal Services

Editorial duties	Publication	Years
Editor-in-chief	Developmental Immunology	1999 - 2003
Member – editorial board	Developmental and Comparative Immunology	1993 - 2003
Member – editorial board	Clinical and Developmental Immunology	2004 - present
Reviewer	Autoimmunity	Ongoing
Reviewer	Blood	Ongoing
Reviewer	Experimental Biology and Medicine	Ongoing
Reviewer	European Journal of Immunology	Ongoing
Reviewer	Immunity	Ongoing
Reviewer	Immunology and Cell Biology	Ongoing
Reviewer	Journal of Autoimmunity	Ongoing
Reviewer	Journal of Clinical Investigation	Ongoing
Reviewer	Journal of Experimental Medicine	Ongoing

Reviewer	Journal of Immunology	Ongoing
Reviewer	Nature	Ongoing
Reviewer	Nature Immunology	Ongoing
Reviewer	Nature Reviews Immunology	Ongoing
Reviewer	Proceedings of the National Academy of Sciences	Ongoing
Reviewer	Trends in Immunology	Ongoing
Reviewer	Journal of Experimental Gerontology	Ongoing
TOTAL:	**Approx: 35-40 manuscript reviews per year**	

International Committees		
Role	**Committee**	**Years**
Co-convenor and member, Scientific advisory board	Discovery, Science and Biotechnology conference, Melbourne.	2006
Chairman	Organising Committee – "Rebuilding Immunity for Better Health – an interface between immunology, stem cells, and regenerative medicine."	2005
Member	Scientific committee – 15th International conference on lymphatic tissues and germinal centres in immune reactions. Potsdarm. Germany.	2005
Member	Scientific Organising Committee, 2nd Australian Stem Cell Conference, Sydney.	2004
Member	Scientific Committee, 14th International conference on lymphatic tissues and germinal centres in immune reactions. Groningen.	2002
Co-chairman	Organising Committee, Australian Society for Immunology Annual General Meeting, Melbourne.	1998
Co-chairman	Organising Committee for International Conference on Germinal Centres and Lymphatic Tissues in Immune Reactions, Graz, Austria.	1996
Chairman	Organising and Scientific Committee, International Workshop on T Lymphocytes, Heron Island. ThymOz I Oct 11 -15, 1995, ThymOz II March 25 - 29, 1998, ThymOz III April 11-18, 2000, ThymOz IV April 1-5, 2003, ThymOv V April 5-10, 2006.	1995, 1998, 2000, 2003, 2006.
Member	Scientific and Organising Committees, Foundation member, International Workshop on the Thymus. Rolduc, The Netherlands.1988, 1991, 1995, 1997, 2001, 2004.	1988, 1991, 1995, 1997, 2001, 2004.
Member	Avian Leucocyte CD nomenclature committee	1990-2000
Member	Organising Committee for Australian Society for Immunology Annual Scientific Meeting, Melbourne.	1990
Member	Cluster of Thymic Epithelial Staining (CTES) nomenclature committee	1989-0995

Member	Organising Committee, German Society for Immunology, Innsbruck.	1979

Invitations to conferences (since 1995)

2007 Invited speaker, Pennington Scientific Symposium, "NeuroImmune Signaling and Inflammation," Baton Rouge, Louisiana, USA

Invited speaker, Discovery, Science and Biotechnology (DSB), Brisbane, Australia

Invited speaker, 1st Australia – China Biomedical Research Conference, Melbourne, Australia.

Invited plenary speaker, 5th ISSCR Annual Meeting, Cairns, QLD, Australia.

Invited speaker, Rolduc Workshop on Thymocyte and T cell Biology, The Netherlands

Invited speaker, Translating Basic HIV Immunology into Novel Interventions Workshop, Garvan Institute of Medical Research, Sydney. Part of 4th IAS Conference on HIV Pathogenesis, Treatment and Prevention.

Invited speaker, Australian Clinical Immunologists and Allergists (ASCIA) Annual Scientific Meeting, Freemantle, WA.

Invited speaker, 3rd Barossa Meeting "Signalling Systems," Barossa Valley, SA.

2006 Invited presenter "Immune based Therapies Working group" of the National Centre in HIV Epidemiology and Clinical Research (University of New South Wales).

Co-convenor and invited speaker – Discovery, Science and Biotechnology, Melbourne.

Invited speaker, Collaborative Planning Meeting between Monash University and the University of Newcastle upon Tyne, Prato.

Invited Presentation, Australian Stem Cell Centre's International Scientific Advisory Board meeting, Toronto.

Invited Lecturer, Science Week Public Lecture Series, Federation Square, Melbourne.

Invited speaker, 2nd Annual meeting of the Monash Infection and Immunity Network, Marysville

Invited Chairperson, Aging Research in Immunology (ARIG) symposium, Paris.

Invited speaker, Australian Stem Cell Centre workshop, "Ethics and Stem Cells – "Stem Cell Research Post the Lockhart Review." AH&MRC Congress, Melbourne.

Invited participant, Monash University delegation to Shanghai Institute for Biological Sciences (SIBS).

Invited speaker, Becton Dickinson National Sales Conference, Fiji.

2005 Invited Speaker, Lorne Cancer Conference, Phillip Island, Victoria, February

Invited Speaker, 8th International Symposium on GnRH Analogues in Cancer and Human Reproduction, February, Salzburg, Austria.

Invited Speaker, Kyoto T Cell Conference, April 6-10, Kyoto, Japan

Invited Speaker, Japanese Society for the Promotion of Science, Core-to-Core Workshop on Thymus Organogenesis' April 11-12. Tokushima, Japan.

Invited Speaker, 3rd Congress of Federation of Immunology Societies of Asia-Oceania (FIMSA), Hangzhou, April 18-22.

Invited Speaker and Scientific Committee member, 15th International conference on lymphatic tissues and Germinal Centres in Immune Reactions . April 20-24 Potsdam, Germany

Invited Speaker Advances in Agricultural and Medical Biotechnology, 29-30 September Kuala Lumpur.

Invited Speaker, 6th Australian Peptide Conference, October 9-14, Hamilton Island, Queensland.

Invited Speaker, 10th Annual Australian Autoimmunity, 19-21st October.

Invited Speaker, Science in the Vines, November, Barossa Valley. South Australia

Invited Symposium Speaker. 35th Annual Meeting Australasian Society for Immunology. December 4-8 Melbourne.

Invited Lecturer, Post-graduate Teaching Workshop, 35th Annual Meeting Australasian Society for Immunology. December 4-8 Melbourne.

2004 Invited Symposium speaker. Swiss Society for Allergy and Immunology, Geneva April 15-17

Invited Speaker, Rolduc International T cell Workshop, Rolduc. The Netherlands. May 1-5.

Invited speaker, Japanese Society for the Promotion of Science, Core-to-Core Workshop on Thymus Organogenesis' . Tokushima August 16-18.

Invited Speaker, ThymUs - International Workshop on the Thymus. Peurto Rico, November.

Invited Speaker and Symposium Chairperson, 2nd Australian Stem Cell Conference/ Australian Health and medical Research Congress, November, Sydney.

Invited Symposium Speaker, British Society for Immunology, December 10th, Harrogate. UK.

Invited Symposium Speaker, Australian Society for Immunology, Adelaide, December

2003 Invited speaker and corporate presentation Bio 2003, Washington June 22-27.

Invited Speaker, Workshop chairman, 1st National Stem cell Conference, Melbourne Oct 9-11.

Invited Speaker, First Barossa Meeting (Science amongst the Vines), "Regeneration". Nov 19-21.

Invited Symposium Speaker, Japanese Society for Immunology, December, 7-10.

2002 Invited symposium speaker, Kyoto T Cell Conf. (KTCC), Kyoto, Japan April 3-5.

Invited Symposium Speaker and Chairman, 14th International Conference on Lymphoid Tissues and Germinal Centres in Immune Reactions, Groningen, The Netherlands, June 23-27.

Invited Symposium Speaker, Federation of Immunological Societies of Australasia, Beijing China, October.

Invited key Note Speaker, Australian Society of Medicine, Canberra, Nov 21-23.

2001 Invited Symposium speaker. Thymus Workshop. Rolduc. Kerkrade. The Netherlands, May 12-15.2001.

Invited Speaker: IgV Meeting, Mt Buffalo, Victoria, October 14-16.

Invited Keynote Address, ThymUS International thymus meeting, Peurto Rico, November 2-6.

Invited Chairperson, ThymUS International Thymus Meeting, Peurto Rico, November 2-6.

Invited Chairperson, Australian Society for Immunology, Canberra. December 1-4.

2000 Invited Symposium speaker and Chairperson, VII International Society Avian Endocrinology, Varanasi, India, Feb 1-5.

Invited Symposium speaker, XXI World Poultry Congress, Montreal, August 20-24.

Invited Chairperson. Australian Society for Immunology, Sydney. Dec.

1999 Invited Speaker, FASEB/Clinical Immunology. Washington April 19-21.

Invited Speaker, Rolduc International Workshop on Thymus, May 1-4.

Invited Speaker, Austrian Academy of Science Special Symposium in Honour of G. Wick, Innsbruck, May 8.

Invited Symposium Speaker, 6th Asia/Oceania Regional Congress of Gerontology, June 8-11.

Invited Speaker and Workshop Chairman, 13th International Conference on Lymphoid Tissues and Germinal Centres in Immune Reactions, Geneva, Switzerland 1-6.

1998 Plenary Chairperson, symposium speaker, 25th Annual Meeting Australian Soc Immunology, Melbouren Nov 29-Dec3.

1997 Invited Chairperson 5th Conference of the Immunology Group of Victoria, Mt. Buffalo, March 16-18.

Invited speaker, International Workshop on Thymus, Rolduc/Kerkrade Holland, March 23-26.

Invited Symposium speaker 5th Kyoto T Cell Meeting, Kyoto, October 2-4.

Invited Symposium speaker and Chairperson, XIIIth Int Congress of Comparative.Endocrinology, Yokoma Nov 17-21.

1996 Invited Symposium Speaker, Australian Poultry Science Symposium, Sydney, Feb 6-7.

Invited Symposium Speaker, International Symposium on Avian Endocrinology, Alberta, Canada, March 31 - April 5.

Invited Keynote Speaker, Avian Immunology Workshop, Obergurgl, Austria, April 21 –24.

Invited Symposium Speaker, 5th International Expert Forum on Immunotherapy and Gene Therapy, Jerusalem, June 4-9, 1996.

Invited Symposium Speaker and Workshop Chairman, 12th International Conference on Lymphoid Tissues and Germinal Centres in Immune Reactions, Graz, Austria, July 1-5, 1996.

Invited Plenary Session Speaker, First Congress of the Federation of Immunological Societies of Asia-Oceania, (ASI) Adelaide, Dec 1-5.

1995 Invited Co-chairman, 9th International Congress of Immunology, San Fransisco, California. USA, July.

TOTAL INVITATIONS PRIOR TO 1995: 16

Patents (as at November 2007)

Application No	Title	Inventor	Status
Provisional Application	Novel thymic cellular populations and uses thereof	Anne Fletcher, Ann Chidgey, Natalie Seach, Richard Boyd	
PCT/AU00/00329	Improvement of T cell mediated immunity Filed on October 13, 2000 as United States Application Serial No. 09/795,302. Previously filed as: PP9778, Australia, April 15, 1999. PCT/AU/00329, Australia, April 17, 2000, PRO745, Australia, October 13, 2000.	Richard Lennox Boyd	Granted 4 countries Pending 6 countries
PCT/AU01/01291	Treatment of T cell disorders	Richard Lennox Boyd	Granted 4 countries Pending 9 countries
PCT/IB01/02739	Haematopoietic stem cell gene therapy	Richard Lennox Boyd	Granted 2 countries Pending 7 countries
PCT/IB01/02740	Improvement of graft acceptance through manipulation of thymic regeneration	Richard Lennox Boyd	Granted 2 countries Pending 7 countries
PCT/IB01/02352	Normalisation of defective T cell responsiveness through manipulation of thymic regeneration	Richard Lennox Boyd	Granted 1 country Pending 6 countries
PCT/IB01/02350	Stimulation of thymus for vaccine development	Richard Lennox Boyd	Granted 3 countries Pending 6 countries
PCT/IB01/02351	Diagnostic indicator of thymic function	Richard Lennox Boyd Ann Patricia Chidgey	Granted 1 country Pending 7 countries
PCT/IB01/02745	Disease prevention by reactivation if the thymus	Richard Lennox Boyd	Granted 3 countries Pending 8 countries
PCT/AU03/00749	Thymic epithelial cells with progenitor capacity	Richard Lennox Boyd	Lapsed
PCT/US2004/011919	Tolerance to graft prior to thymic regeneration	Richard Lennox Boyd Gabrielle Lianne Goldberg Jayne Suzanne Sutherland Ann Patricia Chidgey	Pending 10 countries
PCT/US2004/011913	Disease prevention and vaccination following thymic reactivation	Norwood Immunology Ltd Richard Lennox Boyd Gabrielle Lianne Goldberg Jayne Suzanne Sutherland Ann Patricia Chidgey	Pending 1 country
PCT/US2004/011921	Disease prevention and vaccination prior to thymic reactivation	Norwood Immunology Ltd Richard Lennox Boyd Gabrielle Lianne Goldberg Jayne Suzanne Sutherland Ann Patricia Chidgey	Granted 1 country Pending 9 countries
PCT/US2004/011920	Tolerance to graft following thymic reactivation	Richard Lennox Boyd Gabrielle Lianne Goldberg Jayne Suzanne Sutherland Ann Patricia Chidgey	Pending 1 country

APPENDIX 1:

PUBLICATIONS PRIOR TO 1995

1. **Boyd, R.L.**, Rolland, J.M. and Cauchi, M.N. (1974) Membrane antigenic changes associated with PHA transformation of mouse spleen cells *in vitro*. Immunolog. Commun., **3** : 337-349.

2. **Boyd, R.L.**, Ward, H.A. and Muller, H.K. (1976) Antisera specific for the reticulin of the bursa of Fabricius. Int. Archs of Allergy and Appl. Immunol., **50**:129-132.

3. Clarke, G.N., **Boyd, R.L.** and Muller, H.K. (1977) Actin-like protein in human sperm heads. In "Immunological Influence of Human Fertility" Ed. B. Boettcher, (Academic Press, Sydney, New York, London), pp. 211-214.

4. **Boyd, R.L.** , Toh, B.H., Muller, H.K. and Ward, H.A. (1977) Actin-like protein in chicken and mammalian lymphoid tissue demonstrated by reactivity with human smooth muscle autoantibody. Int. Arch. Allergy Appl. Immunol. **55**:283-292.

5. **Boyd, R.L.** and Ward, H.A. (1978) Lymphoid antigenic determinants of the chicken: cellular representation and tissue localization. Immunology. **34**:9-17.

6. **Boyd, R.L.** and Ward, H.A. (1978) Antigenic changes associated with chicken B lymphocyte development. In "Advances in Experimental Medicine and Biology", 114 Eds. W. Muller-Ruchholtz and H.K. Muller-Hermelink. (Plenum Press, New York), pp.25-30.

7. Wick, G., Kofler, R., Gundolf, R., Muller, P.U. and **Boyd, R.L.** (1979) The nature of effector cells in experimental and spontaneous autoimmune thyroiditis. In 6th International Convocation on Immunology : "Immunopathology", Eds. F. Milgrom and B. Albini, (S. Karger Verlag Basel) pp. 101-106.

8. Wick, G. and **Boyd, R.L.** (1979) Effector mechanisms in thyroid autoimmune diseases. In: Autoimmunity in Thyroid Diseases, Eds. E. Klein and F.A. Forster, (F.K.Schattauer Verlag, Stuttgart, New York) pp. 23-29.

9. **Boyd, R.L.** and Ward, H.A. (1979) Induction of B- and T-cell differentiation by chicken bursa and thymus reticular epithelial cells. In "Cell Biology and Immunology of Leucocyte Function". pp. 235-239.

10. **Boyd, R.L.,** Barr, I.G., Ward, H.A. and Muller, H.K. (1979) Antigeneic and functional properties of bursal and thymic reticular epithelial cells. Folia Biol. **25**:310-312.

11. **Boyd, R**. and Wick, G. (1979) Effector mechanisms in spontaneous autoimmune thyroiditis of Obese strain chickens. Folia Biol. **25**:340-342.

12. **Boyd, R**. and Wick G. (1979) Role of suppressor cells in autoimmune diseases. In European Surgical Research. Ed. W. Brendl, (S. Karger Verlag, Basel) pp.212-213.

13. **Boyd, R**. and Ward H.A. (1979) Antigenic changes associated with chicken B lymphocyte differentiation. Immunobiol. **156**:186.

14. **Boyd, R.,** Schauenstein, K. and Wick, G. (1979) Characterization of effector cells in spontaneous autoimmune thyroiditis. Immunobiol. **156**:244.

15. **Boyd, R.L.** and Wick, G. (1980) Killer cells in the chicken : a microcytotoxicity assay using antigen-coated erythrocytes as targets. J.Immunol. Methods. **35**: 233-247.

16. Wick, G. and **Boyd, R**. (1980) Effector and suppressor cells in Obese strain (OS) chickens with spontaneous autoimmune thyroiditis. Fed. Proc. **39**: 570.

17. **Boyd, R**. and Wick, G (1980) Effector mechanisms in spontaneous autoimmune thyroiditis in Obese strain chickens. In : Proceedings of the Serono Symposia; Ed. D. Doniach, G.F. Fenzi and L. Bachieri. Academic Press, London, New York, pp.199-206.

18. **Boyd, R.L.** and Wick, G. (1981) Ontogenic development of cytotoxic and suppressor cells in Obese strain (OS) chickens with spontaneous thyroiditis. In: Aspects of Developmental and Comparative Immunoloy I. Ed. J.B. Solomon (Pergamon Press, Oxford, New York) pp. 543-544.

19. **Boyd, R.L.**, Barr, I.G., Ward, H.A. and Muller H.K. (1980) Functional and antigenic analysis of the bursal and thymic microenvironments. In : Aspects of Developmental and Comparative Immunology 1. Ed. J.B. Solomon, (Pergamon Press, Oxford, New York) pp.537-538.

20. Wick, G., **Boyd, R.L.**, Hala, K., de Carvalho, L., Muller, P.U. and Cole, R.K. (1981) The Obese strain (OS) of chickens with spontaneous autoimmune thyroiditis. Review of recent data. Curr. Top. Microbiol. and Immunol. **91**: 110-128.

21. Wick, G., **Boyd, R.L.**, de Carvalho, L. and Roitt, I.M. (1981). Analysis of suppressor cells in chickens of the Obese strain (OS) with spontaneous autoimmune thyroiditis. In : Cellular and Molecular Mechanisms of Immunologic Tolerance. Ed. T. Hraba and M. Hasek. Marcel Dekker, Inc. New York, Basel pp. 501-506.

22. Wick, G., **Boyd, R.L.** and de Carvalho, L. (1981) The role of T cells in spontaneous autoimmune thyroiditis in OS chickens. Fed. Proc. **40**: 1140.

23. Hala, K., **Boyd, R.L.** and Wick, G. (1982) Chicken major histo-compatibility complex and disease (review). Scand J. Immunol. **14**: 607-616.

24. Wick, G., **Boyd, R.L.**, Hala, K., Thunold, S. and Kofler, H. (1982) Pathogenesis of spontaneous autoimmune thyroiditis in Obese strain (OS) chickens. Clin. Exp. Immunol. **47:** 1-18.

25. Thunold, S., **Boyd, R.**, Schauenstein, K. and Wick, G. (1982) Tissue localization of lymphocyte surface antigens and receptors for IgG-Fc and C' in the chicken. J. Histochem. Cytochem. **30**: 201-206.

26. Woods, G.M. and **Boyd, R.L.** (1982) Contact-dependent expression of actin in chicken lymphocytes in vitro. Int. Arch. Allergy Appl. Immunol. **67**: 335-339.

27. **Boyd, R.L.** and Wick, G. (1982) Effector mechanisms in the spontaneous autoimmune thyroiditis of Obese strain (OS) chickens : Analysis of cytotoxic cells. Int. Arch. Allergy. Immunol. **69**: 286-295.

28. Wick, G., Schauenstein, K., Thunold, S. and **Boyd, R.L.** (1982) IgG-Fc and C3 receptors in the chickens: distribution tissue localization and functional significance. Molec. Immunol. **19**: 1267-1273.

29. Barr, I.G., Alderton, M.R., Brumley, J.L., **Boyd, R.L.**, Muller, H.K. and Ward H.A. (1982) Antigens associated with bursal and thymic reticular epithelial cells. Advances in Experimental Medicine and Biology. **149**: 711-717.

30. Wick, G., **Boyd, R.L.** and Muller, P.U. (1982) The effect of Cyclosporin A on spontaneous autoimmune thyroiditis in the Obese strain (OS) of chickens. Advances in Experimental Medicine and Biology. **149**: 19-23.

31. **Boyd, R.L.** , Hala, K., Boyd, J. and Wick, G. (1982) Quantitative analysis and interactions of immunoregulatory cells in the chicken thymus. Immunobiol. **163**: 156.

32. Traill, K.N., Bock, G., **Boyd, R.L.** and Wick, G. (1983) Chicken thrombocytes. Isolation, serological and functional characterization using the fluorescence activated cell sorter. Dev. Comp. Immunol. **7**: 111-125.

33. **Boyd, R.L.**, Ward, H.A. and Muller, H.K. (1983) Bursal and thymic reticular epithelial cells in the chicken : Preparation of in vitro monolayer cultures. J. Retic. Soc. **34**: 371-382.

34. **Boyd, R.L.**, Ward, H.A. and Muller, H.K. (1983) Bursal and thymic reticular epithelial cells in the chicken : Induction of B and T lymphocyte differentiation by in vitro monolayer cultures. J. Retic. Soc. **34**: 383-393.

35. **Boyd, R.L.** and Wick, G. (1983) Genetically controlled degree of autoimmune thyroiditis in Obese strain (OS) chickens is expressed at both the humoral and cellular level. Immunol. Commun. **12**: 263-272.

36. **Boyd, R.L.** and Wick, G. (1983) Autoimmune thyroiditis of Obese strain (OS) chickens. Immunopathologie: Collection Foundation Marcel Merieux pp. 113-119.

37. **Boyd, R.L.** and Ward, H.A. (1984) Lymphoid antigenic determinants of the chicken: ontogeny of bursa-dependent lymphoid tissue. Dev. Comp. Immunol. **8**: 149-167.

38. **Boyd, R.L.**, Oberhuber, G., Hala, K. and Wick, G. (1984) Obese strain (OS) chickens with spontaneous autoimmune thyroiditis have a deficiency in thymic nurse cells. J. Immunology, **132**: 718-724.

39. Hala, K., **Boyd, R.L.** , Wolf, H., Bock, G. and Wick, G. (1984) Functional analysis of B-L (Ia-like) antigen bearing chicken peripheral blood cells. Scand. J. Immunol. **20**: 15-19.

40. Wolf, H., Hala, K., **Boyd, R.L.** and Wick, G. (1984) MHC and non-MHC-encoded surface antigens of chicken lymphoid cells and erythrocytes recognized by polyclonal xeno-, allo- and monoclonal antibodies. Eur. J. Immunol. **14**: 831-839.

41. Wick, G., Hala, K., Wolf, H., **Boyd, R.L.** and Schauenstein, K. (1984) Distribution and functional analysis of B-L/Ia positive cells in the chicken : expression of B-L/Ia antigens on thyroid epithelial cells in spontaneous autoimmune thyroiditis. Molec. Immunol. **12**: 1259-1265.

42. Hala, K., Wick, G., **Boyd, R.L.**, Wolf, H., Bock, G. and Ewert, D.L. (1984) The B-L (Ia-like) antigens of the chicken, lymphocyte plasma membrane distribution and tissue localization. Dev. Comp. Immunol. **8**: 673-682.

43. Traill, K.N., Bock, G., **Boyd, R.L.**, Ratheiser, K. and Wick, G. (1984). Ontogeny of surface markers on functionally distinct T cell subsets in the chicken. Eur. J. Immunol. **14**: 61-67.

44. Wick, G., Oberhuber, G., **Boyd, R.L.** and Hala, K. (1984). Obese strain (OS) chickens with spontaneous autoimmune thyroiditis have a deficiency in thymic nurse cells. In: Lymphoid cell function in Ageing, Ed. A.L. de Weck. Topics in Aging Research in Europe, Vol. 3. EURAGE Rijswijk 1984, pp. 39-46.

45. Andrews, P. and **Boyd, R.L.** (1985). The murine thymic nurse cell : an isolated thymic microenvironment. Eur. J. Immunol. **15**: 36-42.

46. **Boyd, R.L.**, Hala, K. and Wick, G. (1985). Interactions and quantitative analysis of immunoregulatory cells in the chicken thymus. J. Immunol. 135: 3039-3049.

47. Andrews, P., **Boyd, R.L.** and Shortman, K. (1985). The limited immunocompetence within murine thymic nurse cells. Eur. J. Immunol. **15**: 1043-1048.

48. Scollay, R., Andrews, P., **Boyd, R**. and Shortman, K. (1985) The role of the thymic cortex and medulla in T cell differentiation. Adv. Exp. Med. Biol. **186**: 229-234.

49. Shortman, K., Scollay, R., Wilson, A., Andrews, P., **Boyd, R**., Butcher, E., Weissman, I. (1986). Mature and immature thymocytes: surface phenotype, immune function and intrathymic location. Prog. in Leukocyte Biology Vol. 5. (Eds. Oppenheim, J.J. and Jacobs, D.M.), pp. 3-10.

50. Shortman, K., Scollay, R., Andrews, P. and **Boyd, R.L.** (1986). Development of T lymphocytes within the thymus and within thymic nurse cells. Current Topics Microbiol. Immunol. **126**: 5-18.

51. **Boyd, R.L.**, Wilson, T.J., Mitrangas, K. and Ward, H.A. (1987) Characterization of chicken thymic and bursal stromal cells. In: Avian Immunology II, Eds W.T.Weber and D.L. Ewert; Alan R. Liss Inc. New York, N.Y. pp 29-39.

52. **Boyd, R.L.** , Mitrangas, K., Ramm, H.C., Wilson, T.J., Fahey, K.J. and Ward, H.A. (1987) Chicken B lymphocyte differentiation : ontogeny, bursal microenvironment and effect of IBD virus. In : Avian Immunology II. Eds. W.T. Weber and D.L. Ewert; Alan R. Liss Inc. New York, N.Y. pp. 41-51.

53. Helme, R.D., Eglezos, A., Dandie, G.W., Andrews, P.V. and **Boyd, R.L.** (1987). The effect of Substance P on the regional lymph node antibody response to antigenic stimulation in capsaicin pre-treated rats. J. Immunol. **139**:3470-3473.

54. Eglezos, A., Helme, R.D., Dandie, G.W., Andrews, P.V. and **Boyd, R.L.** (1988). Substance P-Mediated modulation of the primary antibody response. Adv. Exp. Med. Biol. **237**: 499-503.

55. Godfrey, D.I., Izon, D.J., Wilson, T.J., Tucek, C.L. and **Boyd, R.L.** (1989). Ontogeny, in vitro culture and modulation by immunosuppression in vivo of thymic stromal elements defined by M.Abs. Adv. Exp. Med. Biol. **237**: 269-276

56. Tratkiewicz, J.A., Szer, J. and **Boyd, R.L.** (1989). Are LAK cells a possible form of immunotherapy? Adv. Exp. Med. Biol. **237**: 447-450

57. Tratkiewicz, J.A., Szer, J. and **Boyd, R.L.** (1989). Blood Leukocyte NK activity as an early indicator of leukaemic relapse. Adv. Exp. Med. Biol. **237**: 451-456

58. Ramm, H.C., Mitrangas, K.H., Wilson, T.J., **Boyd, R.L.** and Ward, H.A. (1989). Chicken B lymphocyte differentiation - ontogeny

and bursal microenvironment. Adv. Exp. Med. Biol. **237**: 69-74

59. Wilson, T.J., Mitrangas, K.H., Ramm, H.C., **Boyd, R.L.** and Ward, H.A. (1989). Response of chicken bursa stroma to treatment with cyclophosphamide and IBD virus. Adv. Exp. Med. Biol. **237**: 75-8

60. Shortman, K., Vremec, D., D'Amico, A., Battye, F. and **Boyd, R.L.** (1989). Nature of the thymocytes associated with dendritic cells and macrophages in thymic rosettes. Cell Immunol. **119**: 85-100

61. Tucek, C.L., **Boyd, R.L.** and Hiai, H. (1989) Antigens shared by thymic stromal cells and T lymphocytes are abnormally expressed in AKR thymuses. Thymus 14: 95-107.

62. Van de Water, J., Haapanen, L., **Boyd, R.L.**, Abplanalp, H. and Gershwin, M.E. (1989) Identification of T cells in early dermal lymphocytic infiltrates in avian scleroderma. Arthritis and Rheumatism **32**:73-82

63. Waanders, G.A., Godfrey, D.I. and **Boyd, R.L.** (1989) Modulation of T cell differentiation in murine fetal thymus organ cultures. Thymus **13**:73-82

64. Kampinga, J., Berges, S., **Boyd, R.L.** , Brekelmans, P., Colic, M., van Ewijk, W., Kendall, M., Ladyman, H., Nieuwenhuis, P., Ritter, M., Schuurman, H-J. and Tournefier, A. (1989) Thymic epithelial antibodies: immunohistologic analysis and introduction of CTES nomenclature. Summary of the Rolduc Epithelium Workshop. Thymus **13**:165-173.

65. Izon, D.J., **Boyd, R.L.**, Waanders, G.A. and Kelso, A. (1989). The myelopoietic inducing potential of mouse thymic stromal cells.Cell Immunol. **124**: 264-277

66. **Boyd, R.L.** , Izon, D.J., Godfrey, D.I., Wilson, T.J. and Tucek, C.L. (1989). Complex heterogeneity of the thymic stroma. Adv. Exp. Med. Biol: **237**: 263-269.

67. Izon, D.J. and **Boyd, R.L.** (1990). The cytoarchitecture of the human thymus detected by monoclonal antibodies. Human Immunol. **27**:16-32

68. Tratkiewicz, J., Szer, J. and **Boyd, R.L.** (1990) Lymphokine activated killer cytotoxicity against leukaemic blast cells. Clin. Exp. Immunol. **80**: 94-99.

69. Godfrey, D.I., Izon, D.J., Tucek, C.L., Wilson, T.J., and **Boyd, R.L.** (1990). The phenotypic heterogeneity of murine thymic stromal cells. Immunology, **70**: 66-74.

70. Hugo, P., Waanders, G.A., Scollay, R., Shortman, K. and **Boyd. R.L.** (1990) Ontogeny of a novel $CD4^+$ $CD8^-$ $CD3^-$ thymocyte subpopulation: a comparison with $CD4^-$ $CD8^+$ $CD3^-$ thymocytes. Internat. Immunol. **2**: 209-218.

71. **Boyd R.L.,** Wilson T.J., Mitrangas K. and Ward H.A. (1990). Phenotypic characterization of chicken bursal stromal elements. Dev. Immunol. **1**: 41-51.

72. Wilson T.J. & **Boyd R.L.** (1990). The ontogeny of chicken bursal stromal cells defined by monoclonal antibodies. Dev. Immunol **1**: 31-39.

73. Wilson T.J. and **Boyd R.L.** (1990). Cyclophosphamide and testosterone induced alterations in chicken bursal stroma identified by monoclonal antibodies. Immunology **70**: 241-246.

74. Waanders, G.A. and **Boyd, R.L.** (1990). The effects of IL2 on early and late thymocyte differentiation foetal thymus organ culture. Internat. Immunol. **2**: 461-468.

75. Van de Water, J., Wilson T.J., Haapanen, L.A., **Boyd, R.L.**, Abplanalp, H. and Gershwin, M.E. (1990). Ontogeny of T cell development in avian scleroderma. Clin. Immunol and Immunopathol. **56**: 169-184.

76. Tucek, C.L. and **Boyd, R.L.** (1990). Surface expression of CD4 and Thy-1 on mouse thymic stromal cells. Internat. Immunol. 2: 593-601.

77. Allison, J., Mullbacher, A., Cox, K., Morahan, G., **Boyd, R.,** Scollay, R., Blanden, R.V.and Miller, J.F.A.P. (1990). Selection of the T cell repertoire in transgenic mice expressing a transplantation antigen in distinct thymic subsets. Proc. Royal Soc Lond. B **241**: 170-178.

78. Eglezos, A., Andrews, P.V., **Boyd, R.L.** and Helme, R.D. (1990) Effects of capsaicin treatment on immunoglobulin secretion in the

rat. Further evidence for involvement of tachykinin containing afferent nerves. J. Neuroimmunol. **26**: 131-138

79. Ramm, H.C., Wilson T.J., Boyd, R.L. , Ward, H.A., Mitrangas, K. and Fahey, K.J. (1991). The effect of infectious bursal disease virus on B lymphocytes and bursal stromal components in specific pathogen-free (SPF) chickens. Dev. Comp. Immunol. **15**: 369-381.

80. **Boyd, R.L.** , Wilson, T.J., Van de Water, J., Haapanen, L., Ward, H.A. and Gershwin, M.E. (1991). Selective abnormalities in the thymic microenvironment associated with avian scleroderma, an inherited fibrotic disease of L 200 chickens. J. Autoimmunity **4**: 369-380.

81. Gruschwitz, M.S., Moormann,S., Kromer, G., Sgonc, R., Dietrich, H., Boeck, G., Gershwin, M.E., **Boyd, R.L.** and Wick, G. (1991). Phenotypic analysis of skininfiltrates in comparison with peripheral blood lymphocytes, spleen cells and thymocytes in early avian scleroderma. J. Autoimmunity **4**: 577-593.

82. Hugo, P., Waanders, G.A., Scollay, R., Petrie, H.T. and Boyd, R.L. (1991) Characterization of immature CD4+CD8-CD3- thymocytes. Eur. J. Immunol. **21**: 835-838.

83. Hugo, P., Waanders, G.A., **Boyd, R.L.** and Scollay, R. (1991). CD4+CD8+CD3^{high} thymocyes represent a cortisone-resistant subset differentiating into mature T cells. In: Lymphatic Tissues and In Vivo Immune Responses. Eds.Imhof, B.,Berrih-Aknin,S. and Ezine, S., Marcel Dekker Inc. New York. 1991. p155-160.

84. Hugo, P., Waanders, G.A., Scollay, R., Shortman, K.and **Boyd, R.L.** (1991). CD4+CD8-CD3- thymocytes: an alternative route to generate double positive, CD4+CD8+, thymocytes. In: Lymphatic Tissues and In Vivo Immune Responses. Eds.Imhof, B.,Berrih-Aknin,S. and Ezine, S., Marcel Dekker Inc. New York. 1991 p141-146.

85. Hugo, P., **Boyd, R.L.** , Waanders, G.A., Petrie, H.T. and Scollay, R. (1991).Timing of deletion of autoreactive Vb6+ cells and down-modulation of either CD4 or CD8 on phenotypically distinct CD4+CD8+ subsets of thymocytes expressing intermediate or high levels of T cell receptor. Internat. Immunol. **3**:265-272

86. **Boyd, R.L.** and Hugo, P. (1991). Towards an integrated view of thymopoiesis. Immunology Today **12**: 71-79.

87. Hugo, P., **Boyd, R.L.** and Scollay, R.S. (1991). CD4+CD8+CD3hi thymocytes appear transiently during ontogeny: evidence from phenotypic and functional studies. Eur. J.Immunol. **21:** 2655-2660.

88. Davidson, N.J., Bean, A.G. and Boyd, R.L. (1991). Chicken fetal thymic organ culture: a model for T cell development within the thymic microenvironment.In: Lymphatic Tissues and In Vivo Immune Responses. Eds.Imhof, B.,Berrih-Aknin,S. and Ezine, S., Marcel Dekker Inc. New York. 1991. p89-94.

89. Ladyman, H., **Boyd, R.**, Brekelmans, P., Colic, M., van Ewijk, W., von Gaudecker, B., Kampinga, J. Kendall, M., Nieuwenhuis, P., Schuurman, H-J., Tournefier, A. and Ritter, M. (1991). Monoclonal antiepithelial antibody workshop. II. Flow cytometric analysis and biochemical analysis of thymic epithelial cell heterogeneity. in: Lymphatic Tissues and In vivo Immune Responses. Eds. Imhof, B.A., Berrih-Aknin and Ezine,S. Marcel Dekker Inc. New York. p15-20.

90. Kendall, M.D. and **Boyd, R.L.** (1991). The diversity of thymic epithelial cells. Proceedings of the 10th International Conference on Lymphatic Tissues and Germinal Centres in Immune reactions, Marcel Dekker Inc., New York (in press). Lymphatic Tissues and In vivo Immune Responses. Eds. Imhof, B.A., Berrih- Aknin and Ezine,S. Marcel Dekker Inc. New York.p11-14.

91. **Boyd, R.L.** (1991). Summary of Thymic Epithelium Session., 10th International Conference on Lymphatic Tissues and Germinal Centres in Immune reactions, Compiegne. Thymus Update IV.

92. Eglezos, A., Andrews, P.V., **Boyd, R.L.** and Helme, R.D. (1991). Tachykinin mediated modulation of the primary antibody response in rats: evidence for mediation by an NK-2 receptor. J. Neuroimmunol. **32**: 11-18.

93. Eglezos, A., Andrews, P., **Boyd, R.L.** and Helme, R.D. (1991). Modulation of the immune response by tachykinins (Review). Immunol. Cell Biol. **69**: 285-294.

94. Boyd, R.L. and Obranovich, T.D. (1991). The role of cytokines in the developing chicken immune and haemopoietic systems. Proc. Australian Poultry Science Symposium. 1991.

95. Godfrey, D.I., Masciantonio, M., Tucek, C.L., Malin, M.A., Boyd, R.L. and Hugo, P (1992). TSA 1: A novel thymocyte marker discriminating immature from mature thymocyte subsets. J. Immunology; **148**: 2006-2011.

96. Wilson, T.J., Van de Water, J., Boyd, R.L. , Abplanalp, H. and Gershwin, M.E.(1992). Abnormalities associated with the bursal microenvironment in spontaneous dysgammaglobulinemia of UCD 140 chickens. Clin. Immunol. Immunopathol. **59**(2): 208-221

97. Boyd, R.L. , Wilson, T.J., Ward, H.A. and Gershwin, M.E. (1992). Phenotypic characterization of chicken thymic stromal elements. Dev. Immunol. **2**: 51-66.

98. Wilson, T.J., Davidson, N.J., Gershwin, M.E.and Boyd, R.L. (1992). Phenotypic analysis of the chicken thymic microenvironment during ontogenic development. Dev. Immunol. **2**: 19-27.

99. Davidson, N.J., Chen, C-L. H. and Boyd, R.L. (1992). Kinetics of chicken embryonic thymocyte developement in ovo and in organ culture. Eur. J. Immunol. **122**: 1429-1435.

100. Wilson, T.J., Van der Water, J., Mohr, F.C., Boyd, R.L. , Ansari, A., Wick, G., and Gershwin M.E. (1992). Avian scleroderma: evidence for qualitative and quantitative T cell defects. J. Autoimmunity. **5**: 261-276.

101. Tucek, C.L., Godfrey, D.I. and **Boyd, R.L.** (1992). Five novel antigens illustrate shared antigenicity between mouse thymic stromal cells, thymocytes and peripheral lymphocytes. Internat. Immunol. **4**: 1021-1030.

102. Davidson, N.J. and Boyd, R.L. (1992). Delineation of chicken thymocyte subsets by CD3 - TCR, CD4 and CD8 antigen expression reveals phylogenetically conserved and novel thymocyte subsets. Internat. Immunol. **4**: 1175 - 1182.

103. Waanders, G.A., Hugo,P. and Boyd, R.L. (1992). Treatment of fetal thymic organ culture with IL-1 leads to accelerated differentiation of subsets of CD4-CD8- cells. Cell. Immunol. **143**: 237-245.

104. Duncan,M.R., Wilson,T.J., van der Water, J., Berman, Boyd,R.L., Wick,G. and Gershwin, M.E. (1992). Cultured fibroblasts in avian scleroderma, an autoimmune fibrotic disease, display an activated phenotype. J.Autoimmunity **5**: 603 – 615

105. Davidson, N.J. and Boyd, R.L. (1993). Phenotypic mapping of the chicken embryonic thymic microenvironment within an organ culture system. Dev.Immunol **3**: 147 - 158.

106. Obranovich, T.D. and **Boyd, R.L.** (1993). A bursal stromal cell line induces preferential proliferation of MHC class II bearing precursor cells. Avian Immunology in Progress (INRA editions, **62**): 119 - 124.

107. Davidson, N.J., Bean, A.G.D. and **Boyd, R.L.** (1993). Chicken embryonic thymus organ culture: cellular development and identification of functionally relevant thymic molecules. Avian Immunology in Progress (INRA editions, **62**): 301 - 306.

108. Bean, A.G.D., Davidson,N.J., Ward,H.A. and **Boyd, R.L.** (1993). Two intrathymic lymphoid antigens that define differential thymocyte subsets. Avian Immunology in Progress (INRA editions, **62**): 25 - 30.

109. Siatskas, C. and **Boyd, R.L.** (1993). In vitro stimulation of colony formation by cMGF. Avian Immunology in Progress (INRA editions, **62**): 137 - 142.

110. Watanabe, Y Naiki, M., Wilson, T.J., Godfrey, D.I.,Chiang, B-L., **Boyd, R.L.** , Ansari,A., and Gershwin, M.E. (1993). Thymic microenvirnment abnormalities and thymic selection in NZB. H-2bm12 mice. J. Immunology **150**: 4702 – 4712

111. Lahoud, M., Vremec,D., **Boyd, R.L.** and Shortman, K. (1993). Characterisation of thymic nurse cell lymphocytes using an improved procedure for nurse cell isolation. Dev. Immunol. **3**: 103 - 112.

112. **Boyd, R.L.**, Tucek, C.L., Godfrey, D.I., Izon, D.J., Wilson, T.J., Davidson, N.J., Bean, A.G.D., Ritter, M. and Hugo, P. (1993) The thymic microenvironment. Immunology Today **14**: 445 - 459.

113. Godfrey, D.I., Tucek, C.L., Izon, D.J., Wilson, T.J., Davidson, N.J., Bean, A.G.D., Ritter, M., Hugo, P and **Boyd, R.L.** (1993). The thymic microenvironment Immunology Today **14**: Centre-fold poster: 448-449.

114. Ritter, M. and **Boyd, R.L.** (1993). Development in the thymus: it takes two to tango Immunology Today **14**: 462 - 469.

115. Randle, E., Waanders, G.A. Masciantonio, M., Godfrey,D. and **Boyd, R.L.** (1993). A lymphostromal molecule, Thymic Shared Antigen-1, regulates early thymocyte development in fetal thymus organ culture. J. Immunol. **151**: 6027 - 6035.

116. Ratcliffe, M.J.H., **Boyd, R.L.** , Chen , C-L. and Vainio, O. (1993). Avian CD nomenclature workshop: First report. Vet. Immunol. Immunopathol. **38**: 375-386.

117. MacNeil, I., Kennedy,J., Godfrey, D.I., Jenkins, N.A., Masciantonio, M., Mineo,C., Gilbert, D., Copeland, N.G., **Boyd, R.L.** and Zlotnik, A. (1993). Isolation of a cDNA encoding thymic shared antigen-1: A new member of the Ly6 family with a possible role in T cell development. J.Immunol. **151**: 6913 - 6923.

118. Izon, D.J., Nieland, J.D., Godfrey, D.I., **Boyd, R.L.** and Kruisbeek, A.M. (1994). Flow cytometric analysis reveals unexpected shared antigens between histologically defined populations of thymic stromal cells. Int. Immunol .**33**: 66-67

119. Vicari, A., Abehsira-Amur, O., Papiernik, M., **Boyd, R.L.** and Tucek, C.L. (1994). MTS 32 mAb defines CD4+CD8- thymocyte subsets that differ in their maturation level, lymphokine secretion and selection patterns. J. Immunol. **152**: 333-335.

120. Hanke, T., Mitanacht, R., Boyd, R.L. and Hunig, T. (1994). Induction of Interleukin-2 receptor □ chain expression by self-recognition in the thymus. J. Exp. Med. **180**: 1629-1636.

121. Pircher, H., Ohashi, P.S., **Boyd, R.L.** , Hengartner, H. and Brduscha, K. (1994). Evidence for a selective and multi-step model of T cell differentiation: CD4+CD8low thymocytes selected by a transgenic T cell receptor on major histocompatibility complex class I molecules. Eur. J. Immunol. **24**: 1982 - 1987.

122. Van de Water, J., **Boyd, R.L.** , Wick, G., and Gershwin, M.E. (1994). The immunologic and genetic basis of avian scleroderma, an inherited fibrotic disease of line 200 chickens. Intern. Rev. Immunol. **11**: 273 - 282.

ATTACHMENT B

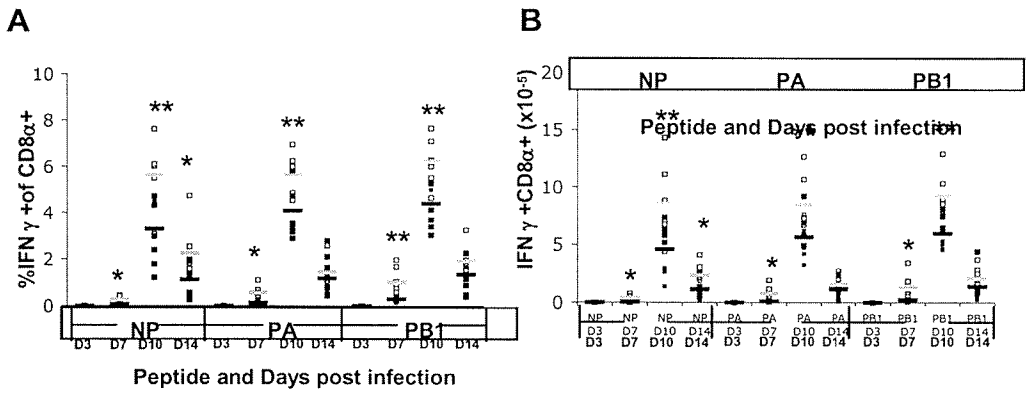


FIGURE.1 Decreases in the response time and magnitude of the primary response to the NP_{366}, PA_{224} and PB_{1703} epitopes in the spleen of aged mice (black squares, mean = black bar) compared to young mice (open square, mean = grey bar). Naïve mice were infected with Hkx31 influenza A virus, and groups of 5 to 6 were sampled 3,7 10 and 14 days later. CD8α+ enriched splenocytes were stimulated for 5 h with 1mM NP366 , PA224 or PB1703 peptide and analysed for expression of CD8α, IFNγ, TNFα and IL2. The percentage (A) and numbers of virus-specific CD8α+ IFNγ expressing cells (B) are shown. Numbers were calculated using cell counts and the percentage of cells staining. The data presented depict the responses of 5 to 6 mice from two or three experiments. Statistical significance was determined using an unpaired two-tailed Student's t test (*, $p<0.05$; **,$p<0.01$).

ATTACHMENT C

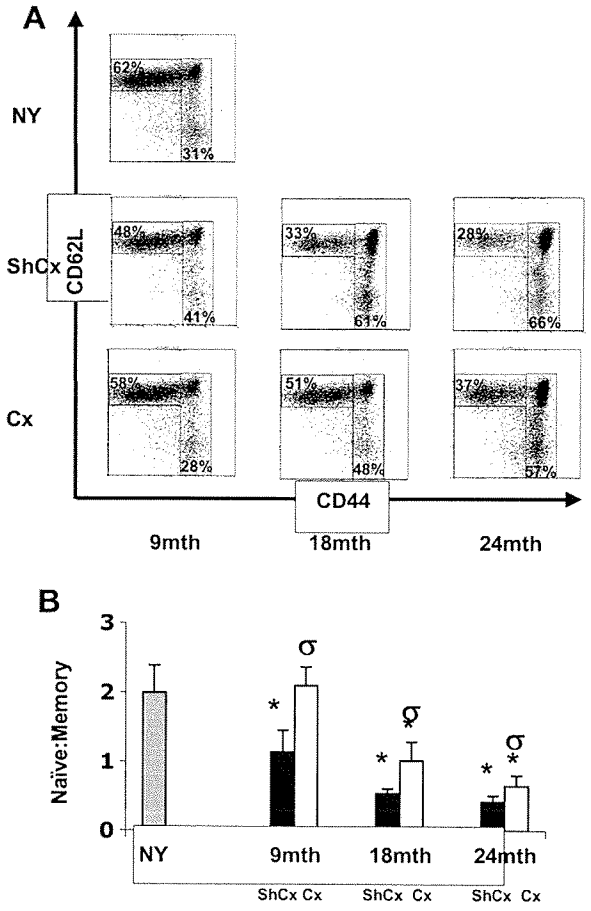


FIGURE 2. Decreases in the naïve to memory ratio with age and the reversal seen with sex steroid ablation. Enriched splenocytes were stained with CD62L and CD44 (A) to obtain a ratio of naïve to memory T cells (B) from NY (grey), 9mth, 18mth and 24mth old that had either been ShCx (black) or Cx (white) 6 weeks prior. Representative facs plots with percentage of naïve (CD62L+CD44-) and memory (CD62L±CD44+) CD8α+ cells shown in bold (A). Statistical significance was determined using an unpaired two-tailed Student's t test (for NY versus ShamCx and Cx •, $p<0.01$; for ShamCx vs Cx σ, $p<0.05$).

ATTACHMENT D

Note: IFNγ+CD8+ cells and NP+ cells are virus specific cells

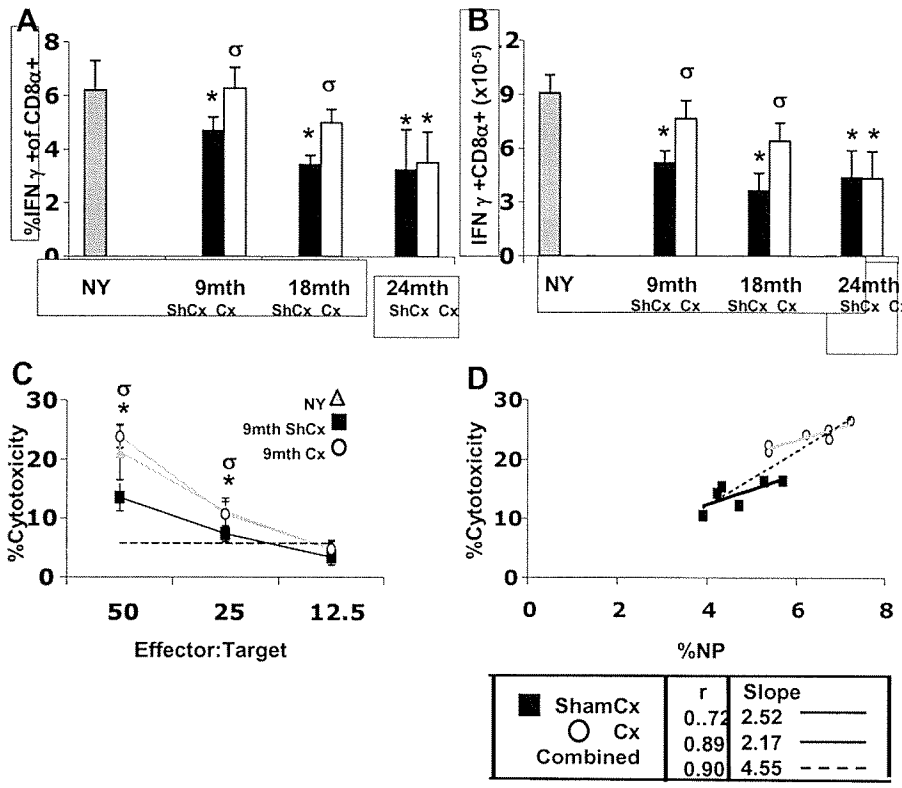


FIGURE 3. Decreases in the magnitude of the primary response to the NP_{366} in aged ShCx mice (black) compared to normal young mice (NY) (grey) and the reversal of this in aged Cx mice (white). Normal young and 9mth, 18mth and 24mth (ShCx or Cx) naïve mice were infected with Hkx31 influenza A virus, and groups of 5 to 6 were sampled 10 days later. CD8α and IFNγ expression was analysed as described in Fig.1. CD8α and IFNγ expression was analysed as described in Fig1. Percentage (A) and number (B) of CD8α+ IFNγ expressing cells are shown for the spleen. The cytotoxicity of splenocytes from normal young (grey triangles) and 9mth old ShCx (black squares) or Cx (open circles) mice were tested against NP_{366}-pulsed EL4 target cells. The values shown are the means and ±SD from 5 to 6 individual mice (C). Correlations between cytotoxic activity (E:T of 50:1) and D^bNP_{366} tetramer staining is shown for 9mth old (ShCx and Cx) individual mice (D). The data presented depict the responses of 5 to 6 mice from two or three experiments. Statistical significance was determined using an unpaired two-tailed Student's t test (for NY versus ShamCx or Cx •, $p<0.05$; for ShamCx vs Cx σ, $p<0.05$).

ATTACHMENT E

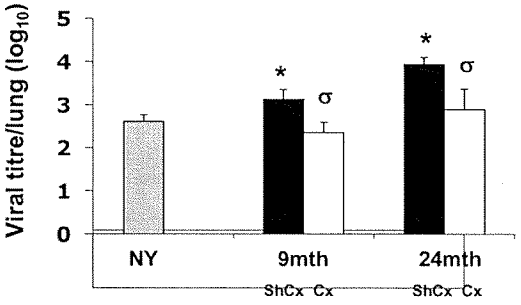


FIGURE 4. Increased viral titres in aged ShCx mice (black) compared to normal young mice (NY (grey)) and the reversal of this following Cx (white). Viral titres were measured (as described in Fig. 3) from NY, 9mth ShCx/Cx and 24mth ShCx/Cx mice 7 days post primary infection. The data presented depict the responses of 5 to 6 mice from two or three experiments. Statistical significance was determined using an unpaired two-tailed Student's t test (for NY versus ShamCx •, $p<0.05$; for ShamCx vs Cx σ, $p<0.05$).